Marine Plants in the Vicinity of the Institut Océanographique de Nha Trang, Viêt Nam[1]

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THE INSTITUT OCÉANOGRAPHIQUE DE NHA TRANG is situated at 12° north latitude on the western shore of the South China Sea. Its splendid physical plant, its magnificent location in the midst of the biological wealth of Nha Trang Bay, and, not the least, the comfortable climate of Nha Trang make it the finest marine laboratory currently operating in southeastern Asia. Its recent rehabilitation after a period of decline and temporary abandonment during World War II has made its exceptional field research facilities available to visiting scientists for the first time in many years. It was my privilege during early 1953 to enjoy the use of these facilities for a period of nearly 3 months.[3]

The long coast of Viêt Nam has been one of the most neglected regions of the world in the field of algology. The literature contains records of less than a score of species from the entire coast, most of these listed nearly a century ago by von Martens (1866). Our knowledge of the algae of the west side of the South China Sea has consisted largely of the works of Tseng on Hainan Island and Hong Kong, together with Setchell's studies of Hong Kong sargassums. These papers represent only fragments of the whole marine flora and deal with areas well north of that now under consideration. Accordingly, it has been necessary to search practically the entire literature on tropical and subtropical marine algae in an effort to identify the plants of Nha Trang. It will be left to future investigators to judge the relative success of this exploratory effort.

Inasmuch as the facilities of the Institut Océanographique will doubtless be used in the future by zoologists of diverse specialties, many of them interested in organisms depending directly upon the algae for food, attachment, or protection, it is felt that the present account should be made as useful to that group of students as possible. Hence, an illustration has been provided for each species, drawn from the local specimens unless otherwise indicated. Artificial keys to the genera and species are also presented as an aid to identifications. For the most part, descriptions are limited to comments which, in addition to the illustrations and keys, may be necessary for identification purposes. Controversial problems of nomenclature have purposely been avoided, but the most applicable taxonomic literature has been cited for each species as an aid to future students of algae in the region. Following the citation of the original description, the type locality or region is indicated in parentheses.

In order that these future investigators may be enabled to determine what plant I have

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had in mind in each instance, my field collection numbers are cited with each species. These numbers will identify the specimens of which the first four sets have been distributed as follows: set 1, U. S. National Herbarium, Washington; set 2, Bishop Museum, Honolulu; set 3, Allan Hancock Foundation, Los Angeles; set 4, Institut Océanographique de Nha Trang. The dates of collection indicated by these numbers are as follows: 11065–11217, January 23–February 1, 1953; 11218–11422, February 2–28, 1953; 11423–11454, March 1–18, 1953.

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Dr. Robert B. Cross kindly prepared the Latin for the diagnoses of new species.

COLLECTING LOCALITIES

The seaweed collector at Nha Trang finds the varied marine plants of the region singularly accessible to him. A large proportion of the species are of intertidal occurrence, and one needs only to choose the times of especially low water to find them conveniently exposed or visible to a wader. The quite numerous small species inhabiting the living and dead coral masses of the lagoons are best obtained by grappling for suitable pieces of coral which may then be searched carefully for these specimens in good light. Only a few species occur which may not be obtained in one of these ways. The larger of these remaining infratidal species, such as *Halymenia* and *Titanophora* which are of infrequent occurs rence, may be located by the use of a water glass and brought up by diver. At depthgreater than about 4 meters, the algae are virtually absent from the biota, which consists of a seemingly infinite diversity of animal forms. Only an occasional macroscopic alga, such as *Galaxaura vietnamensis*, has been taken from Nha Trang Bay in depths of 10–30 meters. Accordingly, the following brief account is concerned mainly with the more fruitful intertidal habitats in the vicinity of the Institut Océanographique.

Cau Da

The shore within 300 meters to the north and south of the Institut yields an interesting diversity of algae, particularly calcified forms associated with living and dead coral. At low tide the cove to the north of the laboratory is the best locality for collecting *Liagora*, *Galaxaura*, *Ceratodictyon*, *Neomeris*, *Turbinaria*, *Boodlea*, *Dictyosphaeria*, and *Amphiroa foliacea*. *Mesospora* is abundant on the smooth rocks at high-water level. The shallow lagoon immediately adjoining the Institut and north of the wharf is rich in *Padina*, *Colpomenia*, *Hydroclathrus*, *Gracilaria crassa*, *Hypnea*, *Liagora*, etc. Depths of 1 or 2 meters here are best for obtaining *Halymenia*, *Titanophora*, *Codium*, and *Caulerpa serrulata*. The shore to the south of the village of Cau Da is not particularly productive of different species, although *Anadyomene* may be found in small quantity. The only *Ulva* association observed by the writer is on rocks adjoining the village of Trúóng Tây.

Cua Be

The sand and mud flats of Cua Be support a distinctive flora entirely unlike that of the coral shore in the vicinity of Cau Da. The marine phanerogams, particularly *Diplanthera*, are dominant here. The shallow pools in the flats exposed at low tide yield many algae, some epiphytic on the phanerogams, others attached to shell and debris or growing directly in the sand. The more conspicuous of these are *Hypnea*, *Spyridia*, *Acanthophora*, *Padina*, *Gracilaria*, *Rosenvingea*, *Avrainvillea*, *Lyngbya*.

A small rocky area along the shore midway between Cau Da and Trủòng Dông yields the only intertidal *Sargassum* near the Institut. The best material of *Halimeda* may be found in this rocky area.

The Sea Wall

Just beyond Rue de la Poste at Nha Trang is a short sea wall and a small adjoining area of rocks. This locality, opposite the main channel into Nha Trang Bay, is subjected to the most violent surf of any section of the inner shore of the bay. The rocks and sea wall are covered with a dense association of algae in which the species are almost without exception different from those found in the vicinity of Cau Da. The genera and some of the species are like those which the writer has observed in similar wave-dashed habitats on the east side of the Pacific along southern Mexico. Several of the dominant species are characteristic of southern Japan and reflect the effect of violent agitation in counteracting the lowered solubility of gases in the warmer waters of lower latitudes. Most conspicuous are the genera *Grateloupia*, *Gymnogongrus*, *Chaetomorpha*, *Cladophora*, *Pterocladia*, *Porphyra*, and *Polysiphonia*.

Cù Lào

The shore just east of Cù Lào varies from sand to rock and supports a number of plants which are not to be found abundantly elsewhere in the bay. *Enteromorpha* is common in the upper intertidal zone, reflecting the influence of the fresh water from the Nha Trang river mouth. Various forms of *Colpomenia* are prevalent in the muddy area. A dense bed of *Sargassum* occurs on a slightly submerged rocky strip leading to an islet. On the seaward side *Gelidiella acerosa* is abundant enough to be collected for food, while *Anadyomene* is common about the base of large rocks of the islet.

Infratidal Coral

A number of species of the smaller, inconspicuous algae may best be obtained by searching coral masses pulled up from depths of 2–3 meters. Those obtainable off the Institut yield such genera as *Valonia*, *Bornetella*, *Udotea*, *Struvea*, *Acetabularia*, *Pseudobryopsis*, *Lithoporella*, *Hypoglossum*, *Gelidiella*, *Ceramium*, *Callithamnion*, *Halicystis*, *Actinotrichia*, etc., as well as diverse Rhodomelaceae. Such coral heads taken from the lagoon at Hòn Miêũ yielded a number of species not found at Cau Da, including several crustose corallines, *Ceramium huysmansii*, and *Gracilaria eucheumoides*.

Black Rocks (*Roches Noires*)

These low rocks, which are entirely awash at high tide, support a marine flora adapted to conditions of high oxygenation provided by the constant wash and surge and the semi-exposure of this habitat. They lack, however, the violent pounding of surf such as obtains at the sea wall locality, and, with only two or three exceptions, the species differ from those found in any other habitats known to the writer in Nha Trang Bay. The dominant vegetation consists of *Chnoospora pacifica*, *Ectocarpus breviarticulatus*, and *Dermonema frappierii*, with lesser components of *Chaetomorpha antennina*, *Ceramium taylorii*, *Laurencia*, *Chondria*, etc.

Binh Cang Bay

The rocky shore along the south side of Binh Cang Bay is readily accessible by Route

Colonial No. 1, which follows the shore for several kilometers north of Km. 15. Here the reef is extensive at low tide, and although the number of species of algae is rather small, several are known to occur intertidally only at this locality: *Boergesenia forbesii*, *Acrocystis nana*, *Udotea javensis*. *Sargassum* is abundant on outer rocks. *Anadyomene* and *Dictyosphaeria* are common, and *Valonia aegagropila* is a dominant rock cover along with *Gelidium pusillum*. *Avrainvillea* occurs in sandy pools inshore on the reef. *Hildenbrandia* is conspicuous among the stones near high-water mark.

Mangrove

The most readily accessible locality for collecting the algae associated with mangroves is along Route Colonial No. 1 where it crosses the mangrove swamp just south of the town of Ninh Hoa. Here the bay edge of the mangroves is only 150 meters to the east. Such characteristic plants as *Catenella* and *Caloglossa* are found, along with several others, on roots and mud. *Halophila beccarii* occurs on exposed mud.

INTERTIDAL STATION LIST

1. Coral cove just north of the laboratory and below the villas.
2. Cau Da harbor area on either side of the wharf.
3. Của Bể, rocky shore about 1 km. south of Cau Da.
4. Sand flats of Của Bẻ (including scattered rocks) near village of Trủỏng Dông.
5. Mud flats adjoining Trủỏng Dông.
6. Sea wall and adjoining small area of shore rocks, near Rue de la Poste, Nha Trang.
7. Coral lagoon on north side of island known as Hon Miêu, off Cau Da.
8. Low ryolite rock known as Roches Noires, off north end of Île de Tre.
9. Rocks at base of cliffs below Bao Dai palace (director's villa).
10. Shore just east of Cù Lào.
11. Rocky shore of Binh Cang Bay along Route Colonial No. 1, opposite Hòn Cù Lào.
12. Mangrove area, inner Binh Cang Bay, just east of Route Colonial No. 1.
13. Southernmost point of island known as Hòn Miêu, off Cau Da.

FLOWERING PLANTS

Key to the Species of Phanerogams

1\. Leaves petiolate, the blades + − oval . . 2
Leaves not petiolate, ligulate to linear . . 3
2\. Leaves without secondary pinnate veins . . . . **Halophila beccarii**
Leaves with 11–14 secondary pinnate veins . . . . **Halophila ovalis**
3\. Leaves linear, about 1 mm. wide . . . . **Diplanthera uninervis**
Leaves coarse, ligulate, 0.5–1.2 cm. wide . . . . **Thalassia hemprichii**

Halophila beccarii Ascherson 1871: 302 (Borneo)
Fig. 1*a–c*

LOCAL DISTRIBUTION: Growing in mud adjoining mangroves, Sta. 12 (11397).

Halophila ovalis (R. Br.) J. D. Hooker 1860: 45; Ostenfeld 1909: 68. *Caulinia ovalis* R. Brown 1810: 339 (tropical Australia)
Fig. 1*d–f*

LOCAL DISTRIBUTION: On sand flats with *Diplanthera* and *Thalassia*, Sta. 4 (11165, 11417); in sand at 5–7 m. off north end of Île de Tre (11283); on mud, Sta. 5 (11193).

These several collections show a relatively small number of veins for this species, 12–14 in the larger sand-flat examples, and 11–13 in the smaller mud-flat examples, but none of them have as few as 7 veins such as are found in the closely related *H. ovata* Gaud.

Diplanthera uninervis (Forsk.) Ascherson 1897: 37; Camus 1942: 1215, figs. 116, 1–5. *Zostera uninervis* Forskål 1775: 159 (Red Sea)

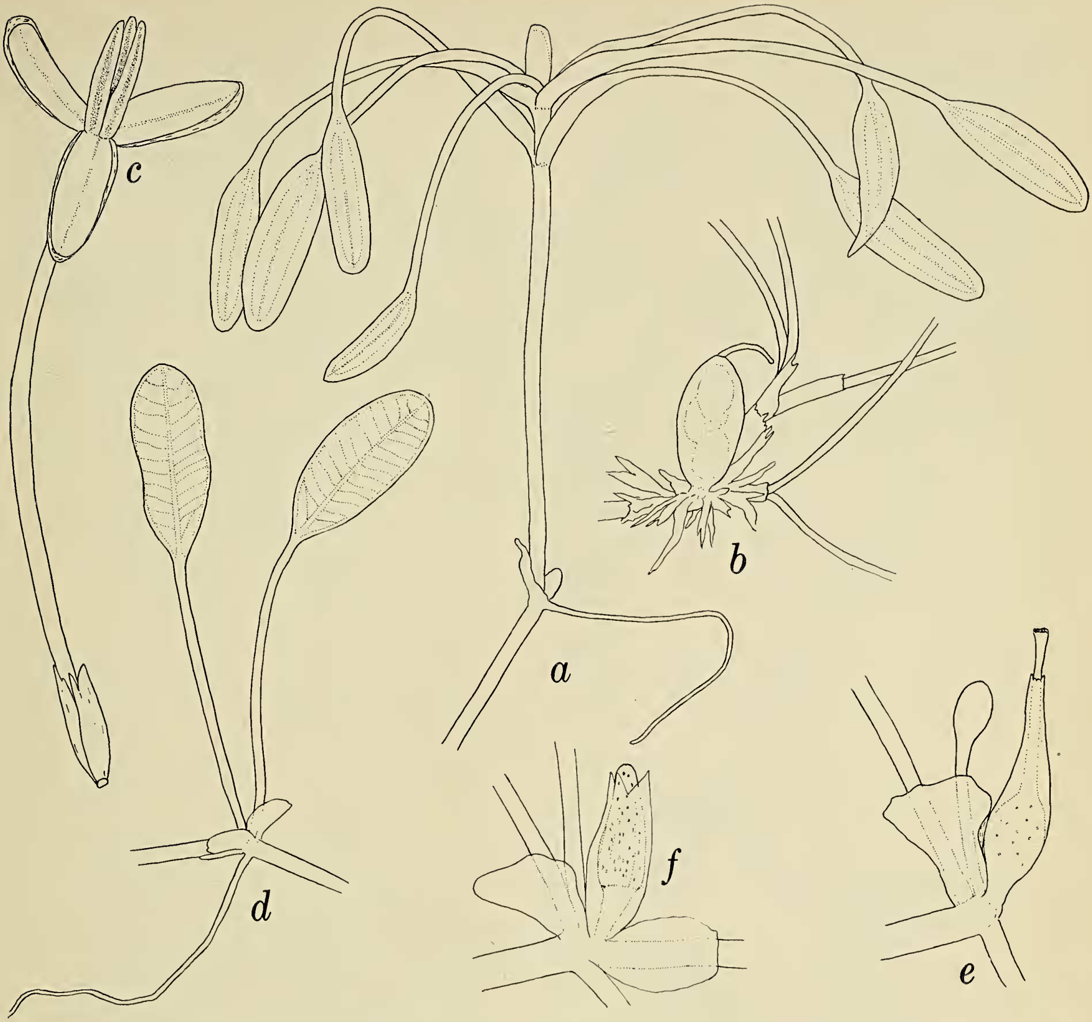

FIG. 1. *a–c*, *Halophila beccarii: a*, Habit of an erect portion of a plant, × 5.5; *b*, a young fruit, × 5; *c*, a male flower, × 5. *d–f*, *Halophila ovalis: d*, A portion of a plant showing leaves, stipules, node, and root, × 2.5; *e*, a female flower, × 3; *f*, a young male flower, × 3.

Fig. 2*a–f*

LOCAL DISTRIBUTION: On mud and sand, Sta. 4–5 (11166, 11418). This is the most abundant marine phanerogam in the area, growing on the flats in dense stands of grass-like habit. It is well exposed at low water.

Thalassia hemprichii (Ehrenb.) Ascherson 1875: 361. *Schizotheca hemprichii* Ehrenberg 1832: 429 (Red Sea)

Fig. 2*g*

LOCAL DISTRIBUTION: On sand flats, Sta. 4 (11164, 11431).

BLUE-GREEN ALGAE

Key to the Species of Cyanophya

1. Plants unicellular, forming small colonies within a gelatinous matrix. . . . .**Entophysalis conferta**

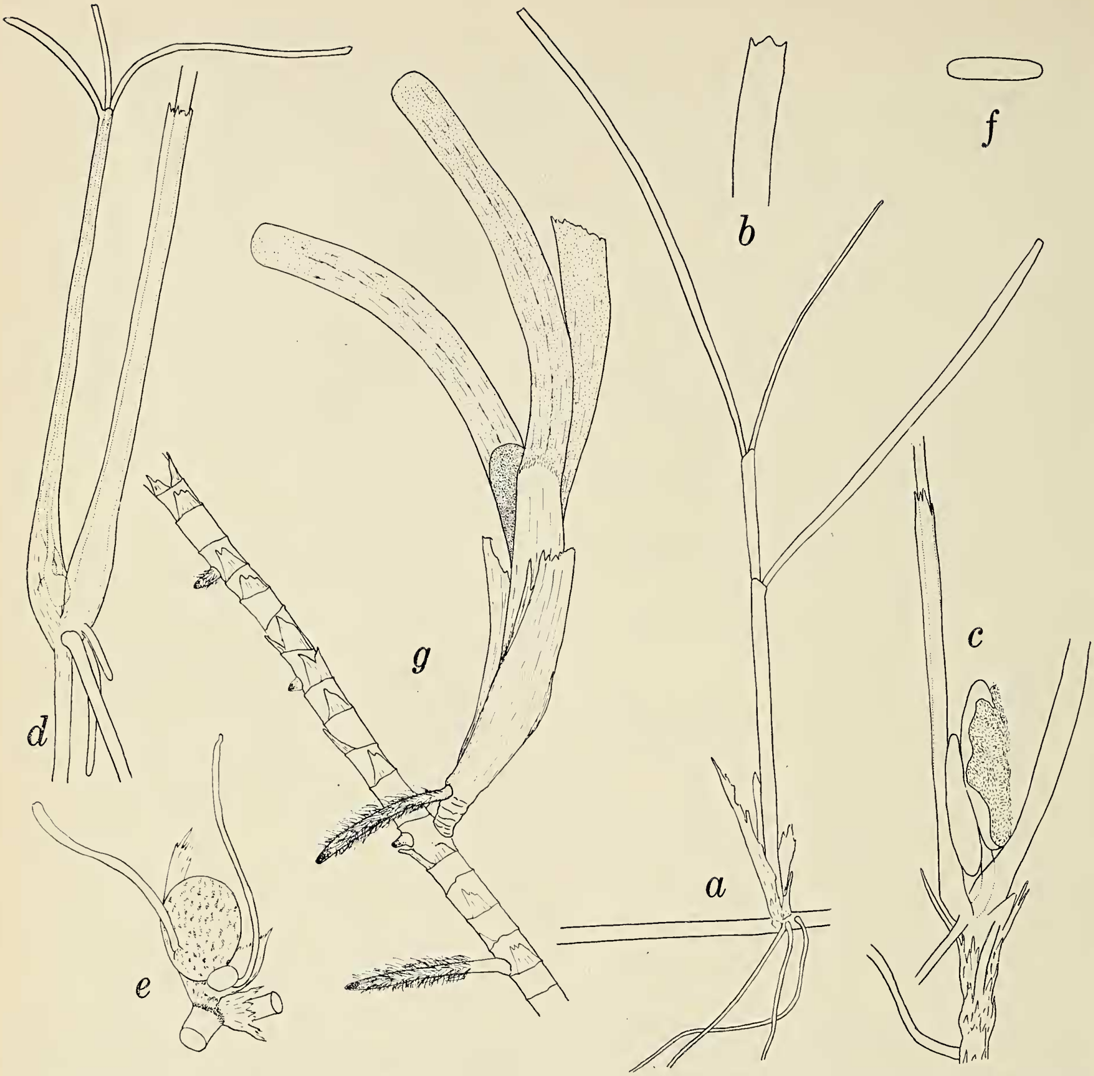

FIG. 2. *a–f*, *Diplanthera uninervis: a*, Habit of a portion of a plant showing rhizome, roots, and erect shoot, × 2; *b*, a leaf tip, × 6; *c*, a portion of a plant bearing a male flower, × 5; *d*, a portion of a plant bearing a female flower; *e*, a young fruit, × 5; *f*, transection of a leaf, × 15. *g*, *Thalassia hemprichii:* An erect shoot and part of a prostrate stem, × 1.

Plants multicellular, filamentous, the filaments free or loosely to densely packed together 2

2. Individual filaments of a simple row of uniform cells; heterocysts absent 9

Heterocysts present 3

3. Individual filaments of a simple row of uniform cells 4

Individual filaments tapered from base to apex 5

4. Trichomes 9–12 μ in diameter . . . . **Hormothamnion solutum**

Trichomes 6–7 μ in diameter . . . . **Hormothamnion enteromorphoides**

5. Filaments densely packed together, forming an expanded, crustaceous, or plicate

to bullate, gelatinous colony 7

Filaments relatively free, forming tufts or velvet-like colonies 6

6. Plants forming velvet-like areas on rocks; filaments about 25 μ in diameter ....**Calothrix pilosa**

Plants epiphytic, forming tiny tufts; filaments 9–12 μ in diameter ....**Calothrix aeruginea**

7. Colonies crustaceous, smooth 8

Colonies plicate-expanded to bullate... ....**Brachytrichia quoyi**

8. Forming a film about 250 μ thick on exposed rocks; heterocysts intercalary; cells irregularly shaped ....**Brachytrichia maculans**

Forming greenish patches on mangrove roots; heterocysts basal; cells regularly shaped ....**Calothrix contarenii**

9. Sheaths not present, or very thin and hyaline, or diffluent 10

Sheaths present, conspicuous 12

10. Filaments about 6.5–8 μ in diameter..11

Filaments about 18 μ in diameter...... ....**Oscillatoria margaritifera**

11. Trichomes not constricted at the septa; filaments epiphytic, adnate, curved..... ....**Hydrocoleum lyngbyaceum**

Trichomes constricted at the septa; often on limpets...**Oscillatoria nigroviridis**

12. Filaments agglutinated, forming thin, crustaceous patches on mangrove roots ....**Phormidium corium**

Filaments fasciculate, entangled or more or less agglutinated, forming an erect spongy tuft to 4 cm. high ....**Symploca hydnoides**

Filaments free 13

13. Plants entangled, commonly epiphytic.. 14

Plants forming silky colonies on rock surfaces; trichomes about 15 μ in diameter ....**Lyngbya confervoides**

14. Trichomes about 30–35 μ in diameter; apices not tapered, broadly rounded ... .**Lyngbya majuscula**

Trichomes about 20–24 μ in diameter with slightly tapered, capitate apices... ....**Lyngbya aestuarii**

Entophysalis conferta (Kütz.) Drouet and Daily 1948: 79. *Palmella conferta* Kützing 1845: 149 (Cuxhaven, Germany)

Fig. 3*r*

LOCAL DISTRIBUTION: Growing as small gelatinous masses on *Lyngbya confervoides* from rocks at end of Cau Da wharf (11300a).

Hormothamnion solutum Bornet and Flahault 1888: 260 (Tongatabu, Polynesia)

Fig. 3*m*

LOCAL DISTRIBUTION: Entangled on other algae and marine phanerogams, Sta. 4 (11199).

Hormothamnion enteromorphoides Bornet and Flahault 1888: 260 (Tongatabu, Polynesia)

Fig. 3*n*

LOCAL DISTRIBUTION: Growing in mixture with *Lyngbya majuscula*, Sta. 4 (R. Serene No. 1161, Aug. 22, 1949)

Calothrix pilosa Bornet and Flahault 1886: 363 (Key West, Florida)

Fig. 3*e*

LOCAL DISTRIBUTION: Forming velvet areas on upper intertidal rocks, Sta. 1 (11065).

Calothrix aeruginea Bornet and Flahault 1886: 358 (Cherbourg, France)

Fig. 3*s*

LOCAL DISTRIBUTION: Growing epiphytically in tiny tufts on small red algae, Sta. 2 (11085).

Calothrix contarenii Bornet and Flahault 1886: 355 (Adriatic Sea); Tseng 1936*c*: 170
Fig. 3*t*

LOCAL DISTRIBUTION: Forming dark greenish patches 3–4 cm. in diameter on mangrove roots, Sta. 12 (11394).

Brachytrichia quoyi Bornet and Flahault 1886: 373 (Marianas Islands); Tseng 1936*c*: 170, fig. 1
Fig. 3*k*, *l*

LOCAL DISTRIBUTION: Growing as blackish-green convoluted colonies 1–3 cm. in diameter at high levels, Sta. 3 (11205, 11430).

Brachytrichia maculans Gomont 1901: 210, pl. 5, figs. 5–7 (Koh Chang, Gulf of Siam); Tseng 1936*c*: 172, fig. 2
Fig. 3*i*, *j*

LOCAL DISTRIBUTION: Forming a dark-green film (drying black) about 250 μ thick at highest vegetation level, Sta. 8 (11254).

Hydrocoleum lyngbyaceum Gomont 1893: 75, pl. 12, figs. 8–10 (presumably Cherbourg, France)
Fig. 3*q*

LOCAL DISTRIBUTION: Epiphytic on a small *Hypnea*, Sta. 8 (11255a).

The diffluent sheaths are invisible in the preserved material from which the figure was drawn. The material is apparently young and the trichomes mostly solitary.

Oscillatoria nigro-viridis Gomont 1893: 237, pl. 6, fig. 20 (near Ayr, Scotland)
Fig. 3*g*

LOCAL DISTRIBUTION: Growing on limpets exposed at mid-tide, Sta. 1 (11066).

Oscillatoria margaritifera Gomont 1893: 236, pl. 6, fig. 19 (Calvados, France)
Fig. 3*f*

LOCAL DISTRIBUTION: Growing on mud under mangroves, Sta. 12 (11401).

Phormidium corium Gomont 1893: 172, pl. 5 (Scandinavia)
Fig. 3*h*

LOCAL DISTRIBUTION: Forming greenish patches on mangrove roots, Sta. 12 (11395).

Symploca hydnoides Gomont 1893: 127, pl. 2, figs. 1–4 (Appin, Scotland)
Fig. 3*o*, *p*

LOCAL DISTRIBUTION: Forming small, dense, mat-like patches on rocks at inshore end of Cau Da wharf (11080); on mud, Sta. 12 (11400); forming fasciculate tufts to 2 cm. high, Sta. 11 (11407); to 4 cm. high in 1 m. depth, Sta. 13 (11435).

Lyngbya confervoides Gomont 1893: 156, pl. 3, figs. 5, 6 (Cadiz, Spain)
Fig. 3*b*, *c*

LOCAL DISTRIBUTION: Forming a cover of slippery, silky filaments on intertidal rocks at the end of Cau Da wharf (11300); on intertidal rocks, Sta. 11 (11406).

Lyngbya majuscula Gomont 1893: 151, pl. 3, figs. 3, 4 (Plymouth, England)
Fig. 3*d*

LOCAL DISTRIBUTION: Growing as fine, entangled skeins to 10 cm. long or more on *Diplanthera*, Sta. 4 (11097).

The filaments may have thinner sheaths than that shown in the figures.

Lyngbya aestuarii Gomont 1893: 147, pl. 3, figs. 1, 2 (Jever, Oldenburg, Germany)
Fig. 3*a*

LOCAL DISTRIBUTION: Forming fine, entangled skeins 3–10 cm. long, Sta. 4 (11171, 11213).

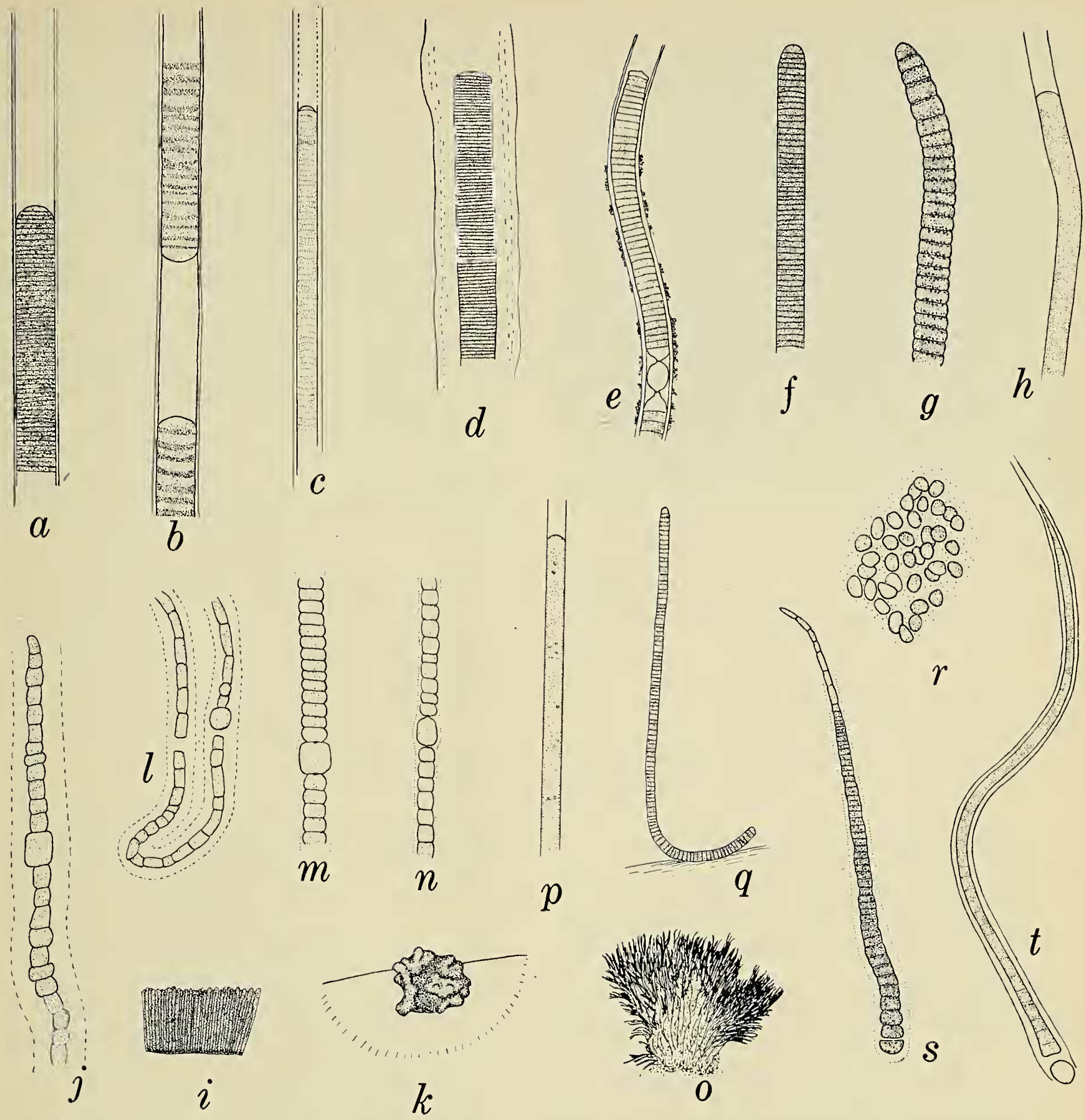

FIG. 3. *a*, *Lyngbya aestuarii:* Terminal portion of a filament showing the slightly tapered and capitate apex of the trichome, × 183. *b*, *c*, *Lyngbya confervoides: b*, Portion of a discontinuous filament 14 μ in diameter (11300), × 400; *c*, portion of a filament 18 μ in diameter including the thick sheath (11406), × 208. *d*, *Lyngbya majuscula:* Terminal portion of a filament 65 μ in diameter including the thick, stratified sheath, showing the blunt, rounded apex, × 150. *e*, *Calothrix pilosa:* Terminal portion of a filament, × 160. *f*, *Oscillatoria margaritifera:* Terminal portion of a filament, × 200. *g*, *Oscillatoria nigro-viridis:* Terminal portion of a filament 6.5 μ in diameter, × 630. *h*, *Phormidium corium:* Portion of a filament 4.5 μ in diameter with thin sheath and indistinct cell walls, × 650. *i*, *j*, *Brachytrichia maculans: i*, Vertical section through the colonial thallus, × 34; *j*, portion of an individual filament within its thick sheath, × 420. *k*, *l*, *Brachytrichia quoyi: k*, Habit of a small colony, × 1; *l*, portion of an individual filament, × 275, *m*, *Hormothamnion solutum:* Small portion of a filament bearing a heterocyst, × 333. *n*, *Hormothamnion enteromorphoides:* Small portion of a filament bearing a heterocyst, × 333. *o*, *p*, *Symploca hydnoides: o*, Habit of a tufted plant, × 1; *p*, portion of a filament 5 μ in diameter with cells 10–12 μ long, × 500. *q*, *Hydrocoleum lyngbyaceum:* A young filament attached to the surface of *Hypnea*, × 257. *r*, *Entophysalis conferta:* A small portion of a gelatinous colony, × 500. *s*, *Calothrix aeruginea:* An individual filament, × 275. *t*, *Calothrix contarenii:* An individual filament separated from a colony, showing the basal heterocyst, × 275.

GREEN ALGAE

Key to the Genera of Chlorophyta

1\. Thallus calcified 2

Thallus uncalcified 5

2\. Plant body or axis cylindrical 3

Plant body or segments flattened 4

3\. Thallus simple, cylindrical . . . **Neomeris**

Thallus with cylindrical axis bearing one or more verticils . . . . **Acetabularia**

4\. Thallus flabellate, not segmented . . . . . . **Udotea**

Thallus consisting of flat segments . . . . **Halimeda**

5\. Thallus simple, essentially one-celled . . 6

Thallus multicellular, or of branched, coenocytic filaments 8

6\. Thallus attached by a penetrating peg . . **Halicystis**

Thallus attached by rhizoids 7

7\. Thallus more or less spherical, the small rhizoids cut off by a septum from the main cell . . . . **Valonia ventricosa**

Thallus elongate, clavate, the rhizoids branched, nonseptate . . . . . **Boergesenia**

8\. Thallus filamentous and branched, or composed of branched, septate or coenocytic filaments 14

Thallus cellular, not filamentous or composed of obvious filaments 9

Thallus filamentous, unbranched, uniseriate . . . . **Chaetomorpha**

9\. Thallus composed of large cells 1 mm. in diameter or more 10

Thallus composed of small cells 11

10\. Thallus hemispherical, solid or hollow, the cells compact . . . . . . **Dictyosphaeria**

Thallus irregular, of non-compacted, coarse, clavate cells . . . . **Valonia aegagropila**

11\. Thallus subspherical or clavate . . . . **Bornetella**

Thallus not subspherical or clavate, composed of expanded, or hollow, cellular membranes 12

12\. Thallus parts hollow, tubular . . . . **Enteromorpha**

Thallus parts expanded, membranous 13

13\. Cells in two layers, irregularly disposed . . . . **Ulva**

Cells in one layer, radially disposed in flabellate blades . . . . **Anadyomene**

14\. Filaments cellular, or at least frequently septate 23

Filaments non-septate or infrequently septate 15

15\. Filaments dichotomously branched . . 16

Filaments not dichotomously branched 19

16\. Filaments growing together to form a large, spongy, flabellate plant body . . . . . **Avrainvillea**

Filaments free, not forming a flabellate plant body 17

17\. Filaments prominently constricted just above the dichotomies . . **Chlorodesmis**

Filaments not constricted at the dichotomies 18

18\. Filaments attenuated from 40–50 μ below to 10–12 μ in ultimate segments . . . . . . **Derbesia**

Filaments increasing in diameter from 60–80 μ near the base to 125 μ above . . . **Pseudochlorodesmis**

19. Plants consisting of coenocytic filaments penetrating coral and shell. **Ostreobium**

    Plants free, not as above **20**

20. Thallus spongy, composed of interlaced filaments forming a surface layer of swollen utricles . . . . **Codium**

    Thallus not spongy, not as above . . . **21**

21. Coenocytic thallus consisting of + − coarse, basal, cylindrical, rhizoid-bearing parts and erect, specialized assimilatory branches . . . . **Caulerpa**

    Coenocytic thallus consisting of several erect axes bearing pinnate or multifarious branches **22**

22. Erect axes bearing pinnate branchlets without basal septa . . . . **Bryopsis**

    Erect axes bearing multifarious branchlets, mostly with basal septa . . . . **Pseudobryopsis**

23. Filaments prostrate, spreading; plants epiphytic or endophytic . . . . **Entocladia**

    Not as above **24**

24. Filaments bearing septa at base of branches **25**

    Filaments mostly without septa at base of branches . . . . **Cladophoropsis**

25. Thalli erect, free **26**

    Thalli congested and anastomosed into a loose, spongy mass . . . . **Boodlea**

26. Thalli rarely branched, 15–19 μ in diameter . . . . **Rhizoclonium**

    Thalli + − abundantly branched, mostly over 20 μ in diameter **27**

27. Branches all free . . . . **Cladophora**

    Branches partially united laterally to form a reticulum of flabellate form . . . **Struvea**

FIG. 4. *Ulva lactuca:* Habit, × 1.

Ulva lactuca Linnaeus 1753: 1163 (England); Tseng 1935: 101; Smith 1944: 45, pl. 3, figs. 6, 7
Fig. 4

LOCAL DISTRIBUTION: Abundant on intertidal rocks adjoining the village of Trůóng Tây (11294).

Key to the Species of *Enteromorpha*

1. Thalli simple, essentially unbranched . . **2**

   Thalli branched **3**

2. Thalli inflated, + − constricted and contorted . . . . **E. intestinalis**

   Thalli smooth, slender . . . . . **E. tubulosa**

3. Branched near the base, the branches simple, but not uniseriate and capillary . . . . **E. kylinii**

   Branched throughout, with many uniseriate, capillary ultimate branchlets . . . . **E. clathrata**

Enteromorpha intestinalis (L.) Link 1820: 5. *Ulva intestinalis* Linnaeus 1755: 418 (Sweden).
Fig. 6*c*

LOCAL DISTRIBUTION: Abundant on rocks, Sta. 6 (11226); Sta. 10 (11334).

FIG. 5. *Enteromorpha kylinii:* Habit of part of a tuft, × 1.25.

Enteromorpha kylinii Bliding 1948: 1, figs. 1–3 (west coast of Sweden)

Fig. 5

LOCAL DISTRIBUTION: Densely tufted, Sta. 2 (11068); on shells and algae, Sta. 4 (11178).

These specimens are in good agreement with Bliding's account. The cells are arranged in longitudinal rows with two or more pyrenoids per cell.

Enteromorpha clathrata (Roth) J. Agardh 1883: 153; Bliding 1944: 331, figs. 5–7. *Conferva clathrata* Roth 1806: 175 (Baltic Sea)

Fig. *6d, e*

LOCAL DISTRIBUTION: Forming a dense, hairy covering 1–3 cm. high on rocks, Sta. 6 (11225); entangled among other algae in drift, Sta. 3 (11096).

The slender, abundantly branched plants of 11096 are in good agreement with Bliding's Type II of this variable species. Those under 11225 are more sparsely branched, but otherwise similar. All have two or more pyrenoids per cell and the cells arranged in + − definite longitudinal rows, usually more so than shown in Fig. *6e*.

Enteromorpha tubulosa (Kütz.) Kützing 1856, Tab. Phyc. 6, pl. 32, fig. 2. *Enteromorpha intestinalis* var. *tubulosa* Kützing 1849: 478 (Europe)

Fig. *6a, b*

LOCAL DISTRIBUTION: Entangled in *Hypnea* growing on sand flats near Sta. 12 (11403).

For practical purposes of recognition I follow Setchell and Gardner (1920) in assigning this unbranched, entangled plant to *E. tubulosa*, although other authors, particularly Bliding (1939) through his interfertility studies, have recognized it as a form of *E. prolifera* (Müller) J. Ag.

Key to the Species of *Chaetomorpha*

1. Filaments attached, tufted 2

   Filaments mostly unattached, entangled, contorted . . . . **C. crassa**

2. Basal cells very long, with annular constrictions near the base; upper cells much longer than broad . . . . **C. antennina**

   Basal cells not exceptionally long, not constricted; upper cells about as long as broad 3

3. Cells of + − variable length above; diameter 60–90 μ . . . . **C. indica**

   Cells + − uniform above; diameter 50–110 μ . . . . **C. javanica**

Chaetomorpha javanica Kützing 1849: 376 (Java); Kützing, Tab. Phyc. 3, pl. 51 IV

Fig. *6h–j*

LOCAL DISTRIBUTION: Growing in hank-like tufts on the sea wall, Sta. 6 (11231).

These plants agree as to basal cell, filament diameter, and cell dimensions with this species as illustrated by Kützing, although the cell walls of his specimens were apparently thinner than those of mine.

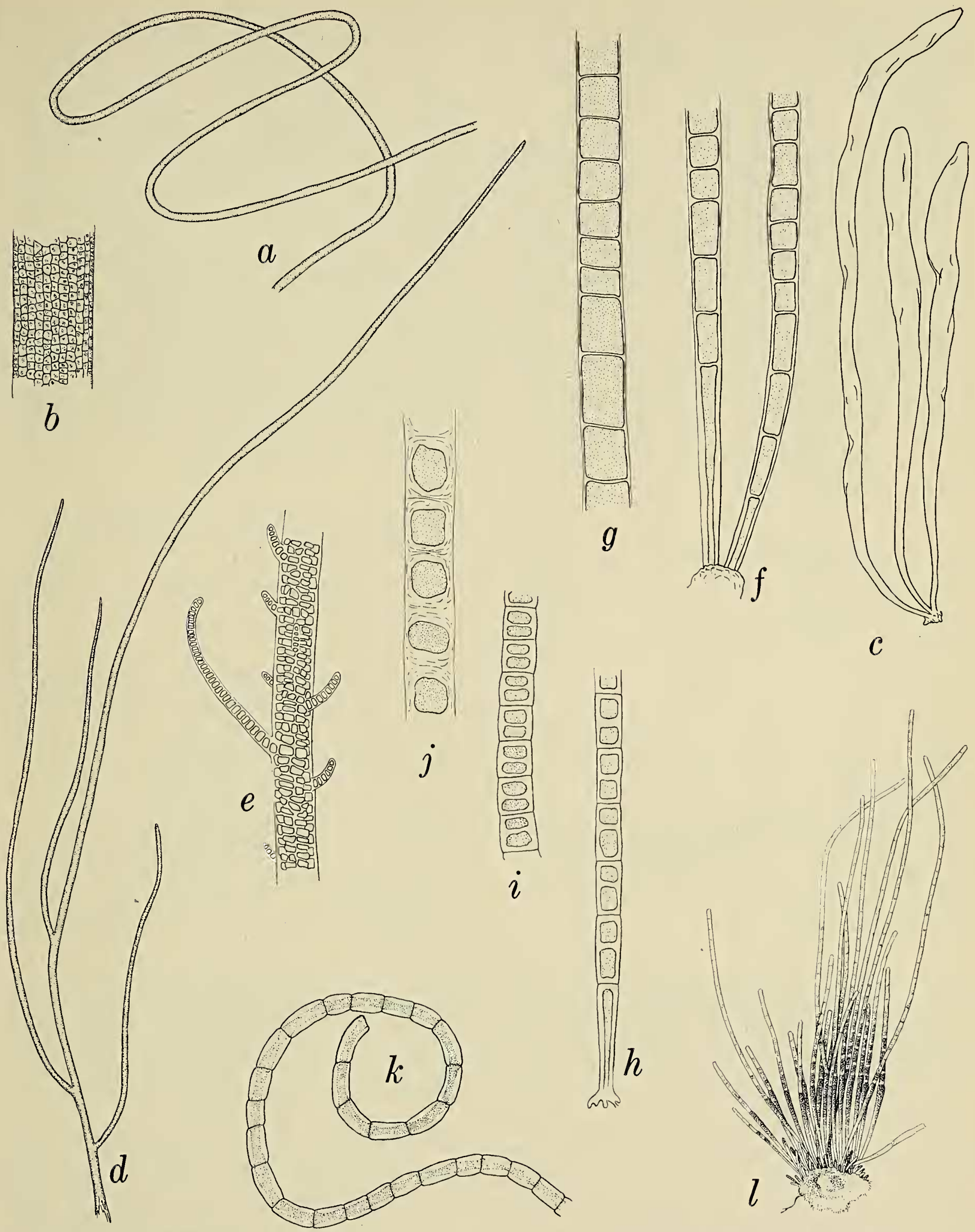

FIG. 6. *a*, *b*, *Enteromorpha tubulosa: a*, Portion of an unbranched, hair-like filament, × 7; *b*, a small portion of a filament showing the cells arranged in rows and the single pyrenoid in each cell, × 82. *c*, *Enteromorpha intestinalis:* Three axes separated from a young tuft, × 6. *d*, *e*, *Enteromorpha clathrata: d*, A young, branched axis, × 15; *e*, an older axis with several uniseriate branchlets, × 80. *f*, *g*, *Chaetomorpha indica: f*, Basal portions of filaments, × 80; *g*, upper portion, × 75. *h–j*, *Chaetomorpha javanica: h*, Basal portion of filament, × 60; *i*, middle portion showing cells dividing, × 60; *j*, older, upper portion, × 60. *k*, *Chaetomorpha crassa:* Small part of a coiled filament, × 8.5. *l*, *Chaetomorpha antennina:* Habit of a portion of a tuft, × 1.5.

Chaetomorpha indica Kützing 1849: 376 (Tranquebar, southeast India); Kützing, Tab. Phyc. 3, pl. 52 III; Børgesen 1935: 12, fig. 2
Fig. 6*f, g*

LOCAL DISTRIBUTION: On rocks, Sta. 10 (11327); on rocks, Sta. 11 (11415).

These specimens have filaments from 60–90 μ in diameter and cells of somewhat varying length, but mostly about as long as broad. They appear to be in good agreement with Kützing's figure and with the *C. indica* interpreted by Børgesen from Bombay, although my plants do not show the slight septal constrictions. As Børgesen says, "The shape of the plant may remind one of *C. aerea*, but it is much thinner."

Chaetomorpha crassa (Ag.) Kützing 1845: 204; Okamura 1931: 97. *Chaetomorpha torulosa* Kützing, Tab. Phyc. 3, pl. 61 II. *Conferva crassa* C. Agardh 1824: 99 (Adriatic Sea)
Fig. 6*k*

LOCAL DISTRIBUTION: A few filaments found entangled in other algae, Sta. 4 (11195); in shallow water, Sta. 2 (11305).

These specimens are 325–475 μ in diameter and well within the range given by Hauck (1885: 439). The walls are thicker than indicated by Kützing.

Chaetomorpha antennina (Bory) Kützing 1849: 379; Dawson 1944: 207. *Conferva antennina* Bory 1804: 161 (Réunion Island)
Fig. 6*l*

LOCAL DISTRIBUTION: Forming scattered, dense tufts at middle levels, Sta. 8 (11264).

Rhizoclonium kerneri Stockmayer 1890: 582 (type not designated)
Fig. 7*a–c*

LOCAL DISTRIBUTION: Forming a soft fleece of entangled and erect filaments, to 2–3 mm. thick, on mangrove roots, Sta. 12 (11393).

These specimens appear to represent the same species as reported by Collins and Hervey (1917: 43) under this name growing as a "coating on mangroves" in Bermuda. The filaments of my plants, 15–19 μ in diameter, are slightly larger than theirs but about the same as is usually reported for this species elsewhere. Børgesen (1913: 20, fig. 8) has found it epiphytic on *Centroceras*. The cells are mostly about 5 diameters long. A branch was found in only one instance. Rhizoids occur rarely from the prostrate cells of filaments next to the substrate. Zoosporangia were observed in which the cells were slightly enlarged at their upper ends and provided there with a discharge pore.

Key to the Species of *Cladophora*

1. Axes less than 30 μ in diameter. . **C. albida**
   Axes over 30 μ in diameter. 2
2. Branching rather remote; cells very long . . . . . **C. patentiramea** f. **longiarticulata**
   Branching abundant; cells not exceptionally long. 3
3. Branchlets fasciculate, curved . . . . **C. inserta** var. **ungulata**
   Branchlets not fasciculate, not markedly curved. . . . . **C. perpusilla**

Cladophora albida (Huds.) Kützing 1843: 267; Kützing, Tab. Phyc. 4, pl. 15, fig. b. *Conferva albida* Hudson 1778: 595 (Great Britain)
Fig. 7*f, g*

LOCAL DISTRIBUTION: Forming soft tufts on rock surfaces, Sta. 6 (11224); on coral heads dredged from 2–3 m., Sta. 2 (11362).

This is the most slender species of the region. The intertidal plants are shorter (to 2 cm. high) than they may often be in calmer habitats, but the slender axes, less than 30 μ in diameter, and the ultimate branches 12–15 μ in diameter with cells 4–5 times as long as

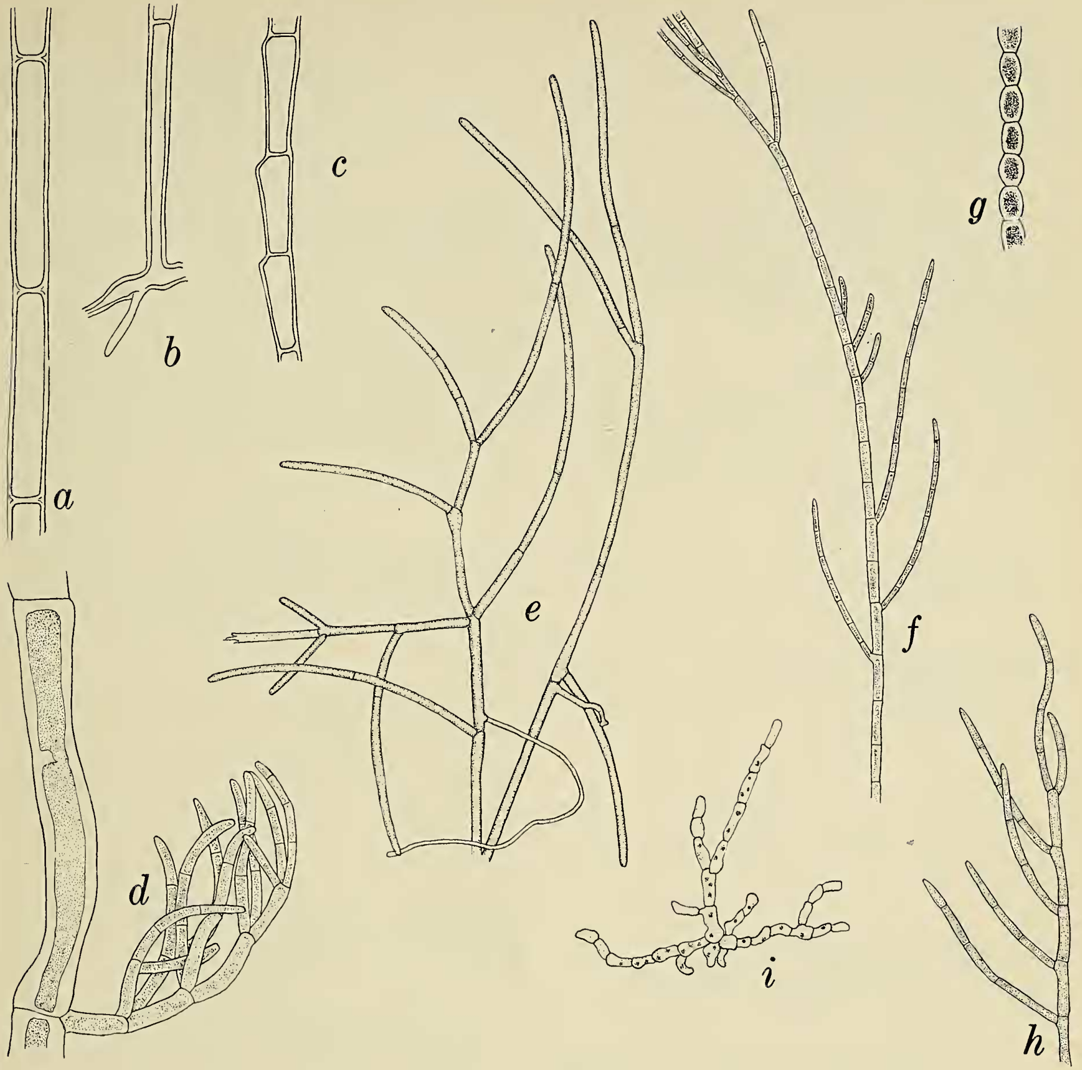

FIG. 7. *a–c*, ***Rhizoclonium kerneri:*** *a*, Upper portion of a filament, × 235; *b*, portion of a prostrate filament bearing a rhizoid and an erect branch, × 200; *c*, zoosporangial cells, × 135. *d*, ***Cladophora inserta*** var. ***ungulata:*** A small portion of a plant to show the reduced size of the curved, fasciculate branchlets compared to a main axis, × 54. *e*, ***Cladophora patentiramea*** f. ***longiarticulata:*** Habit of a portion of a plant, × 13.5. *f*, *g*, ***Cladophora albida:*** *f*, A small portion of a branched axis, × 50; *g*, part of a fertile filament, × 100. *h*, ***Cladophora perpusilla:*** Upper portion of a branched filament, × 22. *i*, ***Entocladia viridis:*** Habit of a plant apart from its host, × 160.

broad, are distinctive features. Recurved branchlets occur rather frequently as is often the case in this species.

Cladophora perpusilla Skottsberg and Levring, in Levring 1941: 611, fig. 2c–f (Juan Fernandez Islands)

Fig. 7*h*

LOCAL DISTRIBUTION: Forming small, dense tufts 7–15 mm. high on saxicolous red algae (11219) and on the seawall (11230), Sta. 6; Sta. 10 (11325).

The lower parts are 60–70 μ in diameter, gradually reduced above to 50–30 μ. Cell form and branching habit are in full accord with the Juan Fernandez plant.

Cladophora inserta var. **ungulata** (Brand) Setchell 1926: 75, pl. 22, fig. 1; Børgesen 1948: 8, fig. 2. *Cladophora mauritiana* var. *ungulata* Brand 1904: 180, pl. 5, figs. 10, 11 (Hawaii)
Fig. 7*d*

LOCAL DISTRIBUTION: Epiphytic as tufts to 2.4 cm. high on saxicolous red algae, Sta. 6 (11232); small and poorly developed on intertidal rocks, Sta. 2 (11083).

Cladophora patentiramea forma **longiarticulata** Reinbold, in Weber van Bosse 1913: 84 (Indonesia; type of the species from Tahiti); Børgesen 1940: 36, fig. 12a–e
Fig. 7*e*

LOCAL DISTRIBUTION: Forming a low, loose mat on intertidal rocks, Sta. 11 (11413).

Entocladia viridis Reinke 1879: 476, pl. 6, figs. 6–9 (Naples, Italy); Kylin 1949: 38, fig. 39
Fig. 7*i*

LOCAL DISTRIBUTION: Abundant in the cell wall of *Cladophoropsis herpestica* from Sta. 4 (11197a).

Halicystis pyriformis Levring 1941: 612, fig. 3L-P (Juan Fernandez Islands)
Fig. 8*a–c*

LOCAL DISTRIBUTION: Attached to crustose corallines on old coral dredged from 2–3 m., Sta. 2 (11382).

The several plants at hand, the largest about 2.2 mm. high, are in excellent agreement with Levring's species. The chromatophores are like those of the type but average smaller, mostly 4–5 μ in diameter. My plants are apparently young, corresponding with his figures 3M–N.

Valonia ventricosa J. Agardh 1887: 96 (St. Croix, Virgin Islands); Okamura 1936: 32, fig. 13; Egerod 1952, pl. 29, fig. a
Fig. 8*e*

LOCAL DISTRIBUTION: Occasional, attached to lower parts of coral masses dredged in 2–3 m., Sta. 2 (11370). These are of rather small size, mostly 1 cm. in diameter or less, and tend to occur in somewhat clustered groups.

Valonia aegagropila C. Agardh 1822: 429 (Venice, Italy); Egerod 1952: 348, pl. 29, fig. b
Fig. 8*j*

LOCAL DISTRIBUTION: Forming small mats on rocks, Sta. 4 (11155); forming extensive, succulent mats dominating rock surfaces at about + 0.5–1.0 foot tide level, Sta. 11 (11355).

Boergesenia forbesii (Harv.) Feldmann 1938: 588, figs. 3–5; Yamada 1950: 174. *Valonia forbesii* Harvey 1859*a*: 333 (Ceylon)
Fig. 8*d*

LOCAL DISTRIBUTION: Occasional on intertidal rocks subject to gentle surf, Sta. 11 (11411). These plants are identical with those illustrated by Tseng (1936b) from nearby Hainan Island.

Dictyosphaeria versluysii Weber van Bosse 1905: 144 (Indonesia)
Fig. 8*k*, *l*

LOCAL DISTRIBUTION: On coral rocks, Sta. 1 (11126).

These plants are rather small compared to *D. versluysii* from some other areas, and their segments are smaller, but it appears unwise in this account to attempt to assign them to *D. vanbosseae*, *D. setchellii*, or *D. australis*, all of which seem unsatisfactorily distinguished from *D. versluysii*.

Dictyosphaeria cavernosa (Forsk.) Børgesen 1932*b*: 2, pl. 1, fig. 1. *Ulva cavernosa* Forskål 1775: 187 (Red Sea). Okamura 1908, Icones 1, pl. 40, figs. 13–24 (as *Dictyosphaeria favulosa* (Mert.) Dec'ne)
Fig. 8*i*

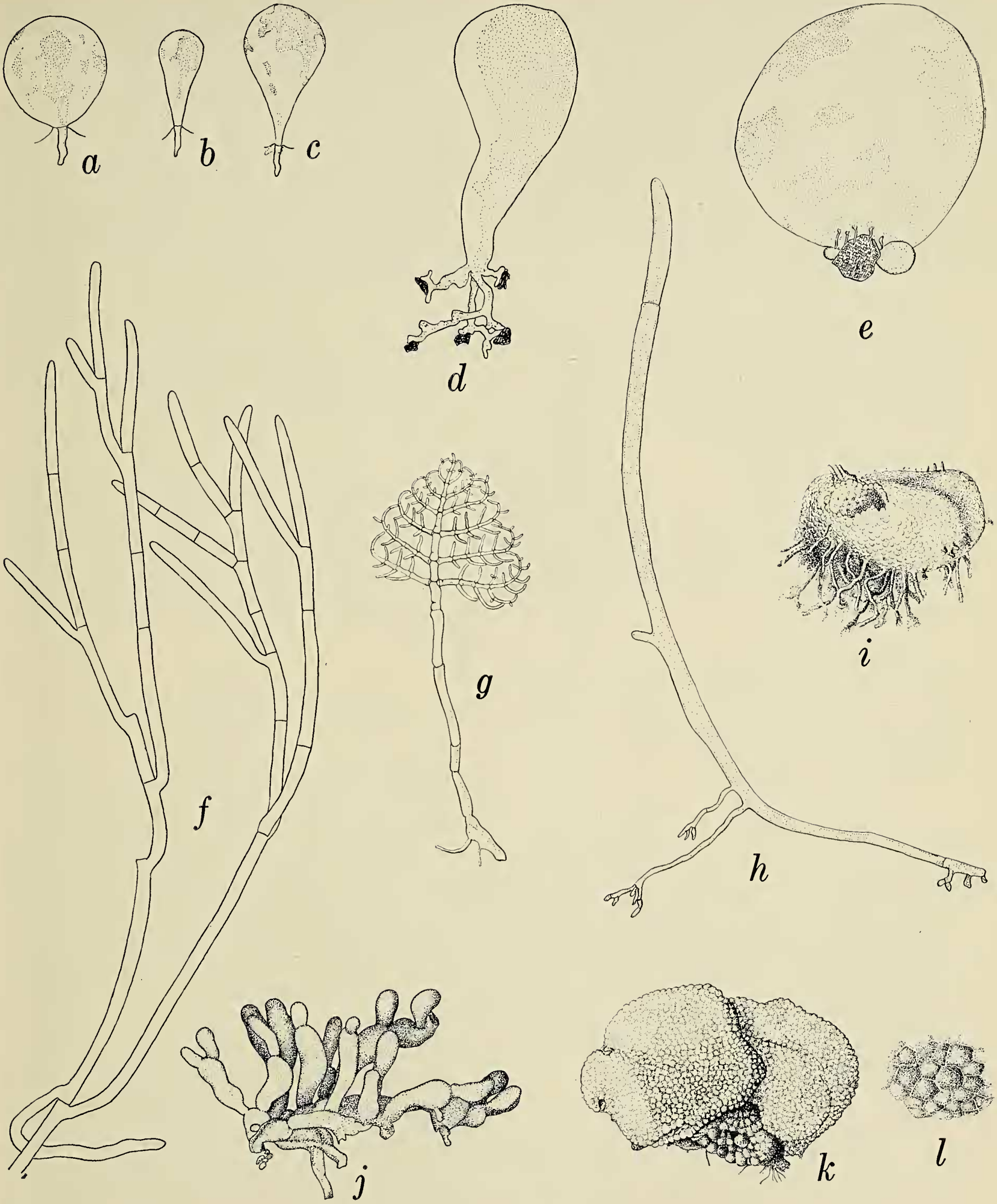

FIG. 8. *a–c*, *Halicystis pyriformis:* Habit of three specimens to show varied shape and the characteristic, penetrating, rhizoidal base, × 10. *d*, *Boergesenia forbesii:* Habit, × 3. *e*, *Valonia ventricosa:* Habit, showing the small rhizoidal organs attached to a sand grain, and two very young plants attached to the base, × 4. *f*, *Cladophoropsis membranacea:* A small part of a plant, × 12. *g*, *Struvea anastomosans:* Habit of a young plant, × 5. *h*, *Cladophoropsis herpestica:* A young plant extracted from a clump, × 6.25. *i*, *Dictyosphaeria cavernosa:* Habit of a specimen with a portion dissected away to show the hollow structure, × 2. *j*, *Valonia aegagropila:* A small part of a matted plant, × 3. *k*, *l*, *Dictyosphaeria versluysii:* *k*, Habit, × 2; *l*, detail of the polygonal segments, × 8.

LOCAL DISTRIBUTION: On rocks, Sta. 4 (11160).

Like the material reported by Tseng (1936*b*) from Hainan, and that illustrated by Okamura (1908), these specimens are rather small, mostly under 2 cm. in diameter. Summer examples have not been seen. The hollow character distinguishes the species from *Dictyosphaeria versluysii*, which is similar in gross appearance, but solid.

Cladophoropsis membranacea (Ag.) Børgesen 1905: 275; Børgesen 1913, p. 42, figs. 26–33. *Conferva membranacea* C. Agardh 1824: 120 (Virgin Islands)

Fig. 8*f*

LOCAL DISTRIBUTION: Sparse, as small loose tufts on coral dredged from 2–3 m., Sta. 2 (11367). The filaments of these average about 225 μ in diameter.

Cladophoropsis herpestica (Mont.) Howe 1914: 31; Setchell 1926: 77, pl. 8, fig. 1. *Conferva herpestica* Montagne 1842: 15 (New Zealand)

Fig. 8*h*

LOCAL DISTRIBUTION: Forming a loose clump, 2–3 cm. in extent, of coarse, + − decumbent filaments, on rocks, Sta. 4 (11197).

These specimens are young and mostly unbranched, but in habit, in diameter (400–500 μ), and in their thick (35–50 μ), stratified walls they are in agreement with Howe's comments on Montagne's type, as well as with other New Zealand specimens.

Struvea anastomosans (Harv.) Piccone and Grunow, ex Piccone 1884*a*: 20; Egerod 1952: 359, pl. 31, fig. 4a–h. *Cladophora* ? *anastomosans* Harvey 1859*b*, pl. 101 (Fremantle, West Australia)

Fig. 8*g*

LOCAL DISTRIBUTION: Occasional on coral heads dredged from 2–3 m., Sta. 2 (11371).

Boodlea composita (Harv.) Brand 1904: 187; Børgesen 1940: 21, fig. 6. *Cladophora composita* Harvey 1834: 157 (Mauritius)

Fig. 9*c*, *d*

LOCAL DISTRIBUTION: Forming irregular, bright green, spongy mats on coral rocks at and below low tide level, Sta. 1 (11119).

Some plants show *Struvea*-like characters in the regular branching of their outermost parts, as in 11313 from Sta. 9.

Anadyomene wrightii Gray 1866: 48, pl. 44, fig. 5 (Ryukyu Archipelago); Okamura 1908, Icones I, pl. 40, figs. 1–6

Fig. 9*e*

LOCAL DISTRIBUTION: Occasional, Sta. 3 (11206); common on exposed rocks beyond the *Sargassum* area, Sta. 10 (11335). These specimens are identical with material collected by the writer on Okinawa in the Ryukyu Islands.

Derbesia attenuata sp. nov.

Fig. 9*a*, *b*

Thallis epiphyticis plerumque solitariis, 2.5–4.5 mm. altis, e parte basali lobata, prostrata, ramata, 1–2 axes dichotomus, erectos, arborescentes emittente; axibus erectis haud ramatis infra, sine constrictionibus, 40–50 μ diametro, regulariter dichotomis supra intervallis 200–300 μ, attenuatis gradatim ad 10–12 diametro; chromatophoriis rotundis, circiter 3 μ diametro.

Thalli minute, epiphytic, usually solitary, 2.5–4.5 mm. high, consisting of a prostrate, branched, and lobed, adherent basal part about 30 μ in diameter and extending 200–300 μ, this giving rise to one or sometimes two erect, arborescent, dichotomously branched axes; erect axes unbranched in their lower 800–1,500 μ, smooth, without constrictions, 40–50 μ in diameter, then regularly dichotomously branched with rather narrow angles at intervals of 200–300 μ and becoming gradually attenuated to 10–12 μ in diameter in the ultimate segments; chromatophores rotund, about 3 μ in diameter; reproduction not seen.

TYPE: Holotype is Dawson 11248, Feb. 3, 1953, in the U. S. National Herbarium.

Type locality: Epiphytic on small filamentous algae growing on coral taken from shallow water of coral lagoon of Hon Miêu, Nha Trang Bay.

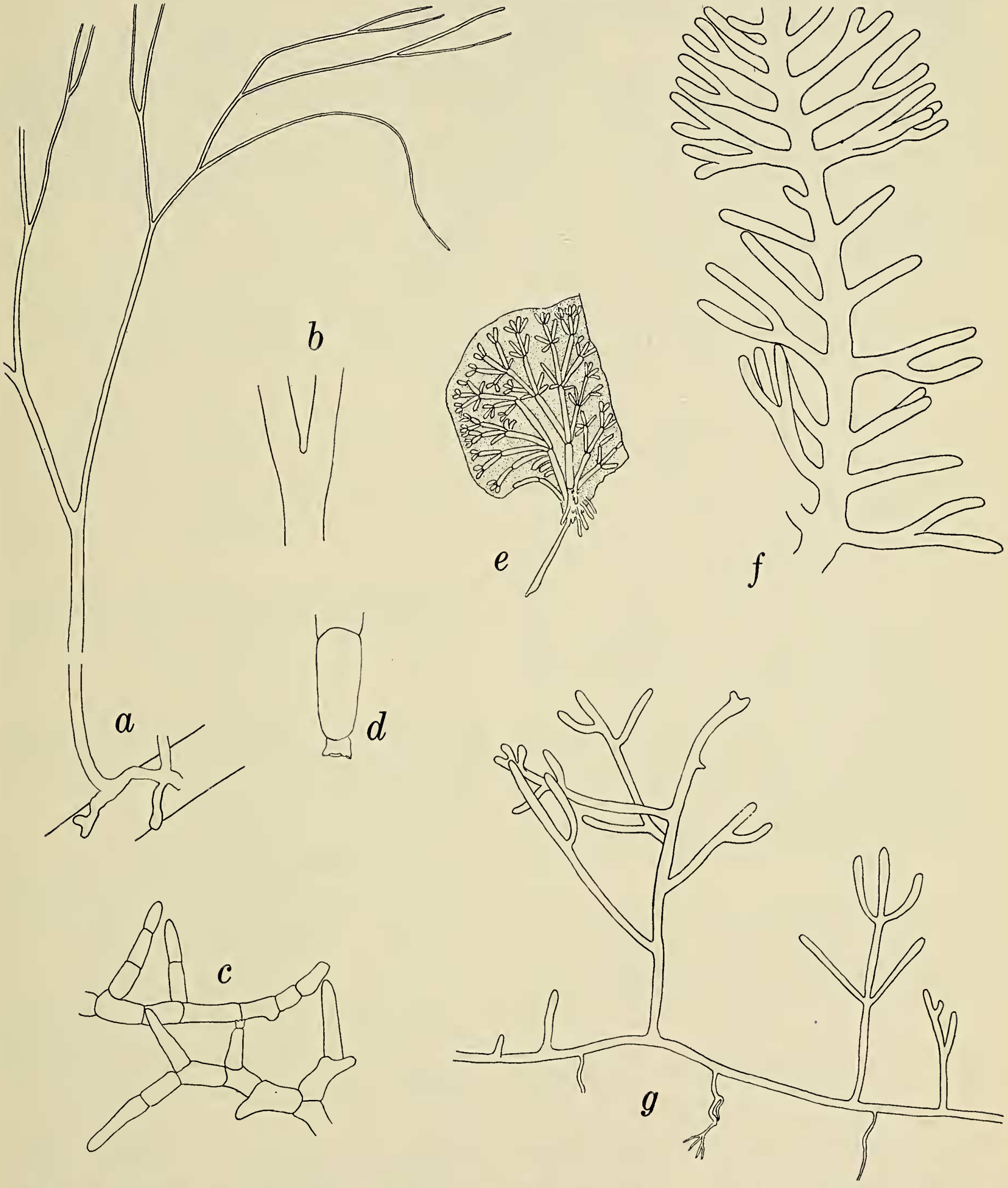

FIG. 9. *a*, *b*, *Derbesia attenuata: a*, A portion of a plant of the type collection to show habit and branching (note: the primary axis has been somewhat shortened in the figure), × 35; *b*, a median dichotomy, × 200. *c*, *d*, *Boodlea composita: c*, A small portion of a mat, × 30; *d*, detail of a tenacula, × 68. *e*, *Anadyomene wrightii:* A portion of a young thallus showing only the larger cells, × 10. *f*, *Caulerpa ambigua:* Upper portion of an axis to show branching, × 65. *g*, *Caulerpa fastigiata:* A small part of a plant showing erect branches and sand-penetrating rhizoids, × 9.

FIG. 10. *a*, *Caulerpa serrulata:* A small part of a plant, × 1.5. *b*, *Caulerpa verticillata:* A small part of a plant, × 5. *c*, *Caulerpa racemosa* var. *macrophysa:* A small part of a plant, × 1.5.

This minute species is similar in size and epiphytic habit to *Derbesia neglecta* Berthold (see Børgesen 1925: 105, figs. 43–44; Hamel 1931: 400), but differs in its solitary habit, regular dichotomous branching above a prominent main axis, and pronounced attenuation to the tips. Inasmuch as the present material is sterile, there remains some doubt as to the generic position, though the vegetative characters point toward *Derbesia*.

Since the above was written this species has been found growing abundantly on old *Galaxaura* at Binners Cove, Isla Socorro, in the Revillagigedo Archipelago (Dawson 12133a, Nov. 19, 1953).

Key to the Species of *Caulerpa*

1. Thalli small, less than 1 cm. high......2

Thalli over 1 cm. high...............3

2. Branching rather sparse, irregular....... ....**C. fastigiata**

Primary branching approximate, pinnate, subopposite..............**C. ambigua**

3. Ultimate branchlets very slender, terete, in subverticillate fascicles.**C. verticillata**

Ultimate branchlets coarse, not terete..4

4. Branches + – contorted, coarsely serrate ....**C. serrulata**

Branchlets terminally inflated.......... ....**C. racemosa** var. **macrophysa**

Caulerpa fastigiata Montagne 1845, pl. 2, fig. 3 (Cuba); Børgesen 1913: 118, fig. 93; Vickers 1908, part 1, pl. 36

Fig. 9*g*

LOCAL DISTRIBUTION: Forming small masses of filaments a few cm. in extent, Sta. 4 (11157).

Caulerpa ambigua Okamura 1897: 4, pl. 1, figs. 3–12 (Ogasawarajima); Okamura, Icones 3, pl. 139; Eubank 1946: 410, pl. 22, figs. a, b; Egerod 1952: 369

Fig. 9*f*

LOCAL DISTRIBUTION: A few small plants less than 1 cm. high attached to a coral head dredged in 2–3 m., Sta. 2 (11366a).

Caulerpa verticillata J. Agardh 1847: 6 (Atlantic Mexico)

Fig. 10*b*

LOCAL DISTRIBUTION: Occasional on intertidal sand flats, Sta. 4 (11161).

Caulerpa serrulata (Forsk.) J. Ag. emend. Børgesen 1932*b*: 5, pl. 1, fig. 2; Tseng 1936*b*: 178, pl. 1. *Fucus serrulatus* Forskål 1775: 179 (Red Sea)

Fig. 10*a*

LOCAL DISTRIBUTION: Occasional in sandy places in 1–2 m., south side of wharf, Sta. 2 (11387).

These specimens represent the type variety *serrulata* of the species.

Caulerpa racemosa var. macrophysa (Kütz.) Taylor 1928: 101, pl. 12, fig. 3, pl. 13, fig. 9. *Chauvinia macrophysa* Kützing 1857, Tab. Phyc. 7, p. 6, pl. 15 II (Central America)

Fig. 10*c*

LOCAL DISTRIBUTION: Specimens of a single collection seen: I.O.N. No. 16, Île de Tre, Aug. 1949.

Bryopsis pennata Lamouroux 1809*a*: 134, pl. 3, fig. 1a, b (Antilles); Egerod 1952: 370, fig. 7

Fig. 11*b*

LOCAL DISTRIBUTION: A few small plants to 13 mm. high on a coral rock dredged from 5–7 m. near Sta. 8 (11275); to 1 cm. high among other small algae, Sta. 9 (11323).

Pseudobryopsis mucronata Børgesen, prox.

Fig. 11*a*

LOCAL DISTRIBUTION: Among other minute algae on bits of debris, dredged from 2–3 m., Sta. 2 (11296).

The several plants examined are sterile. They reach somewhat over 1 cm. in height with much-branched axes to about 120 μ in diameter. The slender, multifarious branches and discoid chromatophores about 6 μ in diameter bearing distinct pyrenoids are much like those of *P. mucronata* Børgesen (1930: 163, fig. 7) from Bombay, although that species becomes as much as 5 cm. high. It is presumed that the present sterile specimens are immature examples.

Pseudobryopsis parva sp. nov.

Fig. 11*d*, *e*

Thallis 5–7 mm. altis, e pluribus axibus simplicibus, pinnis radialiter ordinatis in dimidiis superioribus infixis; adnexione ope rhizoidum; axibus circiter 100 μ diametro ad basim, ad 20–15 μ ad apicem deminutis, infra nudis; pinnis paulo sparsis, haud regulariter radialiter positis, circiter 1.0–1.5 mm. longis, simplicibus, plerumque circiter 20 μ diametro, leviter incurvis; gametangiis sessilibus, elongatis, circiter 190 μ longis, apicaliter subacutis cum poro terminali, plerumque singulatim adaxialiterque prope basim pinnarum singularum fixis.

Thalli 5–7 mm. tall, consisting of several simple axes beset in their upper halves with radially arranged pinnae; attachment by rhizoids; axes about 100 μ in diameter at the base, tapering to 20–15 μ at the tip, barren below; pinnae rather sparse, irregularly radially placed, about 1.0–1.5 mm. long, simple, mostly about 20 μ in diameter, slightly incurved; chloroplasts obscure; gametangia sessile, elongate, about 190 μ long, about 35 μ in diameter at the base, 50 μ at the top, apically subacute with a terminal pore, usually borne singly and adaxially near the base of a pinna.

TYPE: Holotype is Dawson 11375, Feb. 24, 1953, in the U. S. National Herbarium.

Type locality: On the surface of a dead coral fragment dredged from 2–3 meters depth off Cau Da, Nha Trang Bay.

Six species of *Pseudobryopsis* have heretofore been recognized: *P. myura* (J. Ag.) Berth., *P. mucronata* Børg., *P. hainanensis* Tseng, *P. papillata* Nasr, *P. mauritiana* Børg., and *P. oahuensis* Egerod. All of these are discussed by Egerod (1952: 373–374). The present species is much smaller than any of the others and is distinguished by its delicate, simple axes, the relatively sparse pinnate branches, and the elongate, sessile gametangia borne singly near the base of the pinnae.

Chlorodesmis hildebrandtii A. Gepp and Ethel Gepp 1911: 16, 137, figs. 74, 75 (Indonesia); Egerod 1952: 377, pl. 34a, text fig. 9a, b, d

Fig. 11*f*, *g*

FIG. 11. *a*, *Pseudobryopsis mucronata*, prox.: Upper portion of a plant to show septation and branching, × 90. *b*, *Bryopsis pennata:* Terminal portion of a rather young axis (11275), × 27. *c*, *Pseudochlorodesmis furcellata:* A portion of a plant, × 12. *d*, *e*, *Pseudobryopsis parva: d*, Habit of a fertile axis of the type specimen, × 20; *e*, detail of the basal part of a pinna bearing a gametangium, × 118. *f*, *g*, *Chlorodesmis hildebrandtii: f*, A small, terminal portion of a plant, × 12.5; *g*, outline of a dichotomy to show characteristic equal constrictions, × 72.

LOCAL DISTRIBUTION: On coral rocks, Sta. 3 (11214); on coral dredged in 2–3 m., Sta. 2 (11390).

Pseudochlorodesmis furcellata (Zanard.) Børgesen 1925: 78, figs. 30–34; Hamel 1931: 401, fig. 21b; Feldmann 1937: 237, figs. 33, 34. *Bryopsis furcellata* Zanardini 1843: 60 (Adriatic Sea)
Fig. 11*c*

LOCAL DISTRIBUTION: A small amount entangled with *Chlorodesmis* from coral partially embedded in mud at 2–3 m. off Cau Da (11385).

The few filaments detected are sterile and somewhat incomplete as to basal parts, but agree in all essential characters with this species as described and illustrated by the several authors indicated above. Like the Mediterranean type variety, these plants increase in diameter from about 60–80 μ near the base to 125 μ above. The tiny chloroplasts are oval and a little larger (about 4 μ) and less elongate than those illustrated by Feldmann.

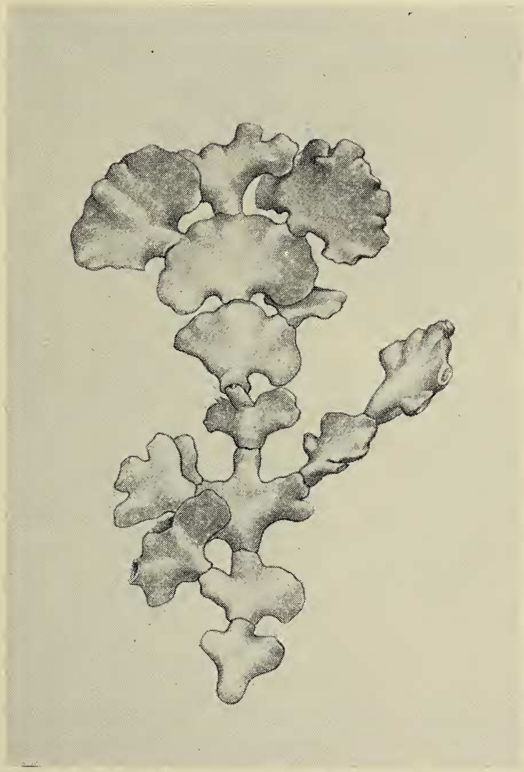

FIG. 12. *Halimeda opuntia:* A small portion of a clump, × 2.7.

Avrainvillea erecta (Berk.) A. Gepp and Ethel Gepp 1911: 29, figs. 84–89. *Dichonema erecta* Berkeley 1842: 157, pl. 7, fig. 11 (Philippines)
Fig. 13*a*

LOCAL DISTRIBUTION: Scattered and solitary on sandy flats, Sta. 4 (11162); in silty pools, Sta. 11 (11404).

The simple, erect habit and the yellow-orange color of the filaments are distinctive. The specimens under 11404 are of softer texture, the filaments being less compacted and free on the margins.

Udotea javensis (Mont.) A. Gepp and Ethel Gepp 1904: 363. *Rhipidosiphon javensis* Montagne 1842: 15 (Java)
Fig. 13*b*, *c*

LOCAL DISTRIBUTION: Frequent on coral dredged in 2–3 m., Sta. 2 (11365); observed in abundance on intertidal rocks and coral fragments, Sta. 11.

Codium geppii O. C. Schmidt 1923: 50, fig. 33 (Malaya); Børgesen 1946: 49, figs. 195–199
Fig. 13*k*

LOCAL DISTRIBUTION: Rare, Sta. 3 (11207); infrequent on living and dead coral in 2–3 m., Sta. 3 (11386, 11442); Cù Lào, col. R. Serene, May 4, 1950.

This is apparently the only *Codium* species in the area and is nowhere abundant during the January–March season.

Halimeda opuntia (L.) Lamouroux 1816: 308. *Corallina opuntia* Linnaeus 1758: 805, in part (Mediterranean Sea)
Fig. 12

LOCAL DISTRIBUTION: Forming congested clumps on dead coral partially embedded in sand, Sta. 3 (11186).

Halimeda gracilis Harvey, ex J. Agardh 1887: 82 (Ceylon)
Fig. 13*f*

LOCAL DISTRIBUTION: A single fragment of a plant attached to a bit of *Colpomenia* was found in drift at Sta. 10 (11333).

The segments have the shape and texture of those of *H. gracilis* f. *lata* illustrated by Taylor (1950, pl. 42) from Bikini and are quite identical in size with those of his smallest example (5–8 mm. wide). Structurally my specimen agrees with Taylor's description although the cortical utricles are not particularly angular in surface view and are even smaller than he indicates (15–25 μ diam.).

Ostreobium reineckei Bornet, in Reinbold 1896: 269, fig. 55 (Samoa); Setchell 1924: 256, fig. 55
Fig. 13*g*

LOCAL DISTRIBUTION: Growing within fragments of dead coral, Sta. 1 (11304).

This minute, filamentous, coral-boring alga often lends a greenish color to the coral fragments it inhabits but cannot otherwise be observed without decalcifying the coral. The irregularly shaped filaments range from 3 to 10 μ in diameter. Several species have been described from different corals, and it is to be expected that some others may be encountered at Nha Trang after careful search.

Neomeris annulata Dickie 1874: 198 (Mauritius); Egerod 1952: 400, pl. 40, text fig. 21a–l, 22a, c
Fig. 13*e*

LOCAL DISTRIBUTION: Common in groups of a few to several score on dead coral fragments, Sta. 1 (11116); Sta. 3 (11210).

This is a conspicuous, though tiny, plant because of its bright yellow-green tips and shining, white, calcified lower parts.

Bornetella oligospora Solms-Laubach 1893: 81, pl. 9, figs. 1–4, 6, 7 (Malaya); Gilbert 1943: 26, fig. 1g, h
Fig. 13*d*

LOCAL DISTRIBUTION: Occasional on coral masses dredged from 2–3 m., Sta. 2 (11363).

Although the aplanosporangia are immature in these, they are spherical and numerous on the primary branches, as in this species versus *B. nitida*.

Bornetella sphaerica (Zanard.) Solms-Laubach 1893: 92, pl. 9, fig. 8; Egerod 1952: 407, pl. 42, fig. 22d–g. *Neomeris sphaerica* Zanardini 1878: 38 (Malaya)
Fig. 13*i*

LOCAL DISTRIBUTION: A single specimen found on coral dredged from 2–3 m., Sta. 2 (11384). Being sterile, this plant is referred to *B. sphaerica* rather than to *B. capitata* (Harv.) J. Ag. with some question.

Acetabularia caliculus Lamouroux 1824: 621, pl. 90, figs. 6, 7 (Australia); Tseng 1936*b*: 155, fig. 16.
Fig. 13*h*

LOCAL DISTRIBUTION: Several plants attached to a shell, Sta. 4 (11172). These are all immature, although that illustrated has produced its gametangial disc and may be considered to be of full stature. It is about 2 cm. high and agrees with the *A. caliculus* of Tseng (1936*b*) from nearby Hainan. The species may be recognized by its whorls of assimilating hairs below the basin-shaped gametangial disc of about 30 rays. The rays of my plant are not emarginate as is usual in this species, although such a young plant may not necessarily be expected to show this character.

Acetabularia moebii Solms-Laubach 1895: 30, pl. 4, fig. 1 (Mauritius); Egerod 1952: 411, fig. 23i

Fig. 13*j*

LOCAL DISTRIBUTION: Occasional on dead coral dredged from 2–3 m., Sta. 2 (11368);

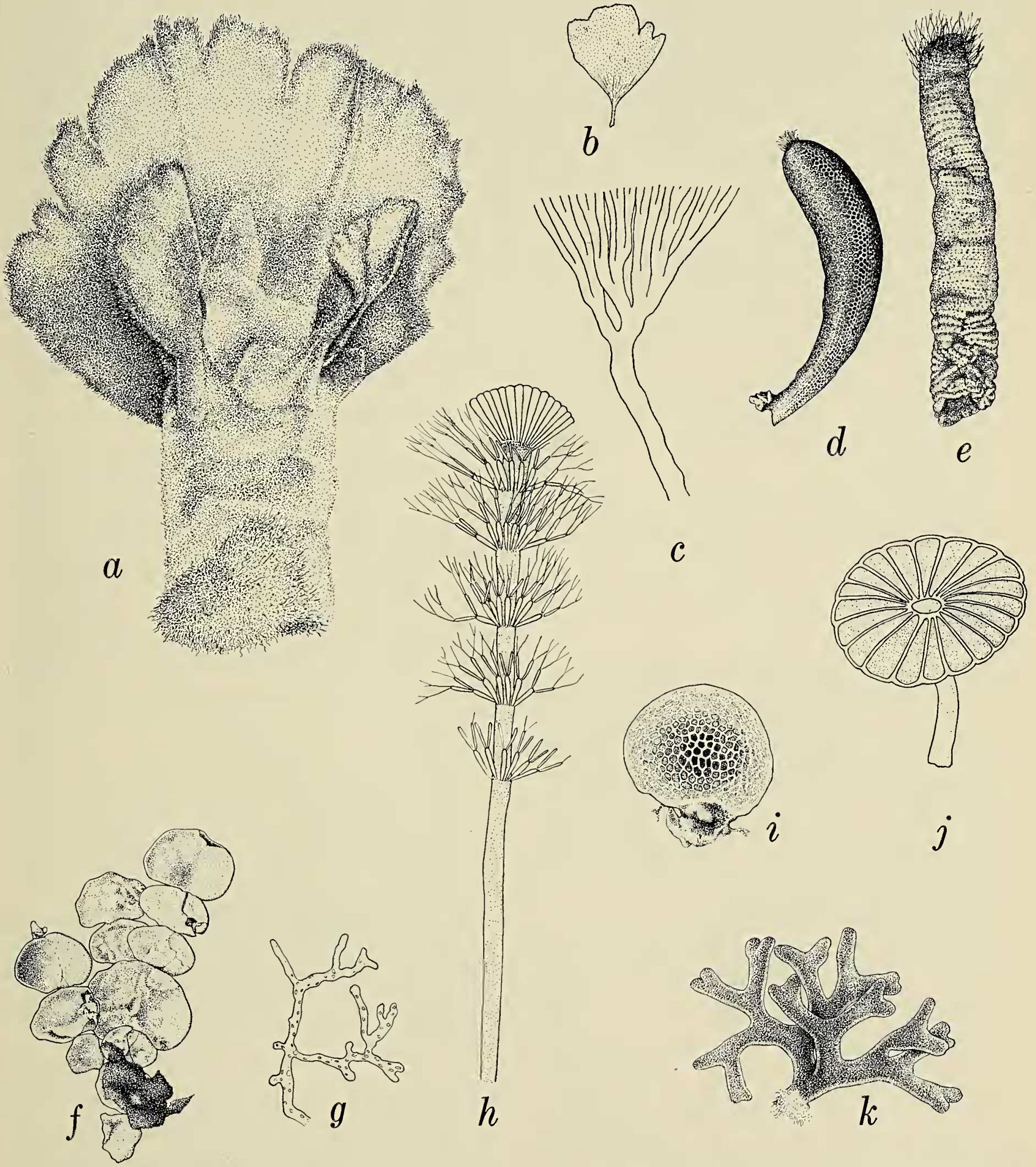

FIG. 13. *a*, *Avrainvillea erecta:* Habit, × 1. *b*, *c*, *Udotea javensis:* *b*, Habit, × 1; *c*, detail of the basal part of the same to show structure, × 21. *d*, *Bornetella oligospora:* Habit, × 2. *e*, *Neomeris annulata:* Upper portion of an actively growing specimen, × 5. *f*, *Halimeda gracilis:* An upper portion of a plant, × 2. *g*, *Ostreobium reineckei:* A small portion of a ramified plant after decalcification, × 250. *h*, *Acetabularia caliculus:* Upper portion of an immature plant, × 7.5. *i*, *Bornetella sphaerica:* Habit, × 4. *j*, *Acetabularia moebii:* Habit, × 7.5. *k*, *Codium geppii:* Habit of a young plant, × 1.

BROWN ALGAE

Key to the Genera of Phaeophyta

1. Thallus crustose 2

Thallus not crustose 4

2. Crust loosely attached, partially free . . . . **Pocockiella**

Crust firmly adherent to rock surface throughout 3

3. Thallus lubricous, consisting of erect filaments of + – catenate cells, readily separating under slight pressure . . . . **Mesospora**

Thallus not particularly lubricous; cells not catenate; filaments not separating easily . . . . **Ralfsia**

4. Thallus delicate, consisting of branched filaments less than 100 μ in diameter . . 5

Thallus more massive, not consisting of branched filaments 6

5. Filaments uniseriate, attenuated, without large terminal cells . . . . **Ectocarpus**

Filaments with both transverse and vertical walls; with large terminal cells . . . . **Sphacelaria**

6. Thallus reticulate . . . . . . **Hydroclathrus**

Thallus not reticulate 7

7. Thallus hollow, bullate or tubular 8

Thallus solid 9

8. Thallus branched . . . . **Rosenvingea**

Thallus unbranched, smooth, papillate or lobed . . . . **Colpomenia**

9. Thallus thin, membranous throughout. 10

Thallus with terete axes 11

10. Thallus fan-shaped . . . . **Padina**

Thallus dichotomously branched . . . . **Dictyota**

11. Branches terete, similar to the axes . . . . **Chnoospora**

Branches of specialized form 12

12. Ultimate branchlets consisting of leaf-like blades and hollow vesicles . . . . **Sargassum**

Ultimate branchlets coarse, obconical . . . . **Turbinaria**

Key to the Species of *Ectocarpus*

1. Plurilocular sporangia short, pyriform . . . . **E. breviarticulatus**

Plurilocular sporangia elongate 2

2. Plurilocular sporangia with acute tips . . . . **E. irregularis**

Plurilocular sporangia with blunt tips . . . . **E. mitchellae**

Ectocarpus breviarticulatus J. Agardh 1847: 7 (Pacific southern Mexico); Børgesen 1914: 17, fig. 10a–d; Setchell 1924: 171, fig. 37

Fig. 14*a*, *b*

LOCAL DISTRIBUTION: Dominant with *Chnoospora pacifica* on rocks, Sta. 8 (11263). An epiphytic form also occurs on the *Chnoospora* (11271).

This species is characterized by the presence of numerous hooked branchlets which hold the filaments in rope-like, spongy strands. The short, pyriform sporangia, about 40 μ long, are also distinctive.

Ectocarpus irregularis Kützing 1845: 234 (Adriatic Sea); Kützing Tab. Phyc. 5, pl. 62, fig. 1; Børgesen 1941: 23, figs. 8–11 (extensive synonymy)

Fig. 14*e*, *f*

LOCAL DISTRIBUTION: Growing in soft tufts to 1.5 cm. high on non-coral rocks, Sta. 2

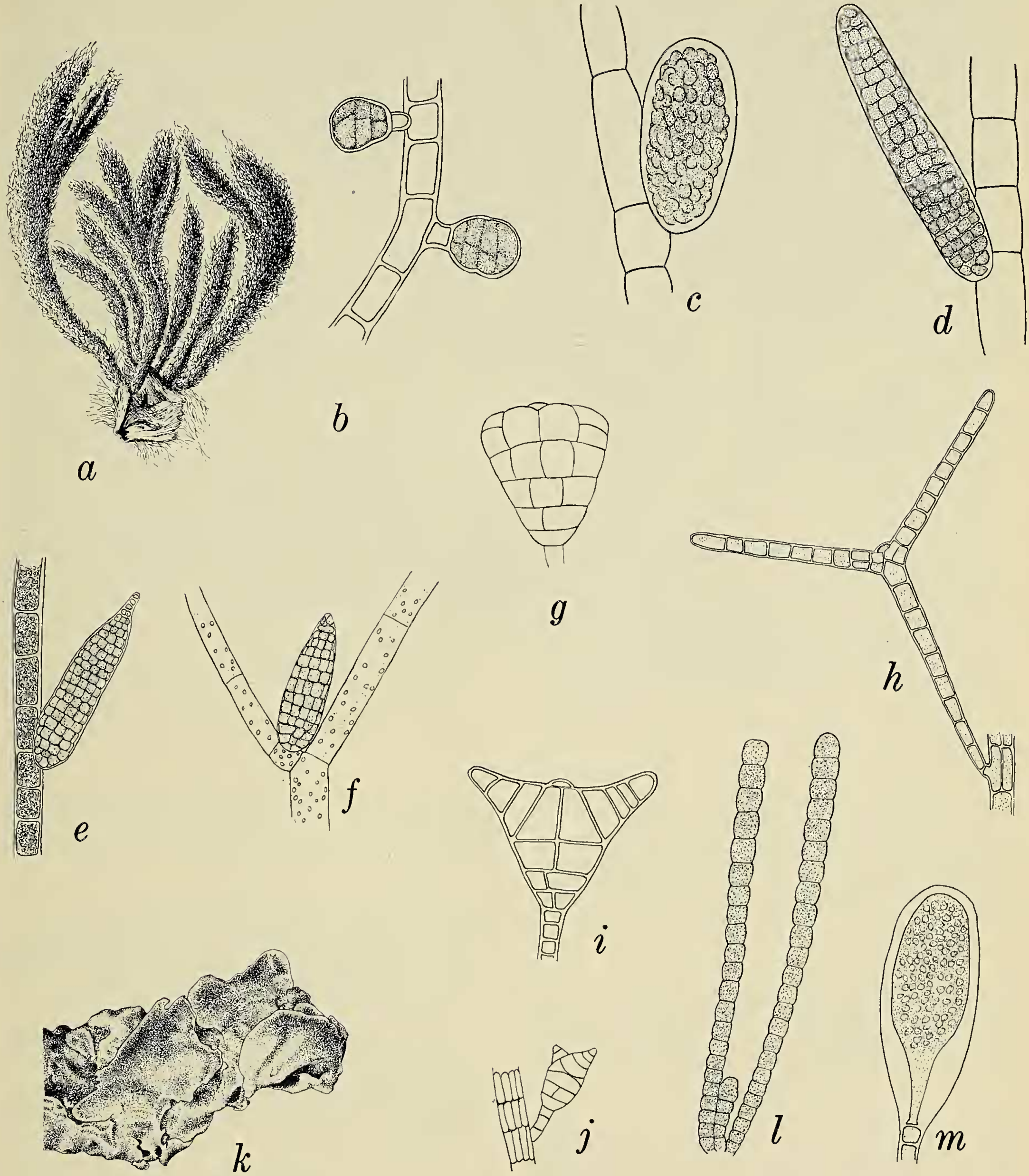

FIG. 14. *a*, *b*, *Ectocarpus breviarticulatus: a*, Habit, × 1.5; *b*, a small portion of a filament bearing two plurilocular sporangia, × 237. *c*, *d*, *Ectocarpus mitchellae: c*, A unilocular sporangium, × 373; *d*, a plurilocular sporangium, × 373. *e*, *f*, *Ectocarpus irregularis: e*, A plurilocular sporangium from 11208, × 200; *f*, a plurilocular sporangium from 11089, × 215. *g*, *Sphacelaria novae-hollandiae:* A propagulum, × 176. *h*, *Sphacelaria furcigera:* A propagulum, × 135. *i*, *j*, *Sphacelaria tribuloides: i*, A propagulum, × 210; *j*, a propagulum in partial side view, × 100. *k*, *Pocockiella variegata:* Part of a fragment of coral enveloped by a plant, × 1. *l*, *m*, *Mesospora schmidtii: l*, Vegetative filaments separated from a film, × 275; *m*, a unilocular sporangium, × 275.

(11089); epiphytic on *Codium*, Sta. 3 (11208).

Børgesen has discussed this species at length and shown that it is a widespread and variable plant of warm seas, having been described and illustrated under many different names. The Nha Trang specimens show considerable variability, some being saxicolous, others epiphytic. The discoid chromatophores and sessile, terminally acute, plurilocular sporangia are characteristic. Figure 14*e* is virtually identical with Weber van Bosse's figure 36 (1913) of an epiphytic plant from Indonesia which Børgesen has identified as *Ectocarpus irregularis*.

Ectocarpus mitchellae Harvey 1852: 142, pl. 12 G (Massachusetts); Børgesen 1941: 7, figs. 1–5
Fig. 14*c*, *d*

LOCAL DISTRIBUTION: Forming tufts to 2.5 cm. high on intertidal rocks: Sta. 8 (11269); Sta. 1 (11087); Sta. 2 (11301).

The presence of unilocular as well as plurilocular sporangia in 11087 is in accord with the Mauritius plants studied by Børgesen. The plurilocular sporangia in 11269 are generally somewhat tapered, as in his figure 1a, and as generally found in this species, while those of 11301 are longer, more blunt, and cylindrical, as seems to be more characteristic of *Ectocarpus indicus* Sond. Yet they are like his figure 1b.

Mesospora schmidtii Weber van Bosse 1910: 27 (Indonesia); Weber van Bosse 1913: 143, fig. 43, pl. 2, figs. 2, 3
Fig. 14*l*, *m*

LOCAL DISTRIBUTION: Abundant, forming a dark-brown film, very slippery when wet, over large areas of high, exposed rocks, Sta. 1 (11074).

The films are about 200 μ thick, composed of densely compacted, erect filaments as in Figure 14*l*. In January these were producing unilocular sporangia abundantly, but plurilocular sporangia were not seen.

Ralfsia sp.

A few limpet shells are present in the collections from Sta. 9 which bear crusts of a species of *Ralfsia*. These show ascending rows of compact, + − angular cells terminating in paraphyses which bear immature plurilocular sporangia. The material is not suitable for identification but indicates the presence of the genus.

Sphacelaria novae-hollandiae G. Sonder 1845: 50 (West Australia); Børgesen 1941: 45, fig. 20a–d; Taylor 1950: 97
Fig. 14*g*

LOCAL DISTRIBUTION: On coral fragments, Sta. 7 (11244).

The propagulae are about 100 μ long and have the corner cells divided by a wall into two superimposed halves. The plants are apparently identical with those of Taylor from Bikini and of Børgesen from Mauritius.

Sphacelaria furcigera Kützing 1855, Tab. Phyc. 5, pl. 90, fig. 2 (Karak Island, Persian Gulf); Børgesen 1941: 46, fig. 21
Fig. 14*h*

LOCAL DISTRIBUTION: Forming low, dense tufts less than 1 cm. high on rocks, Sta. 11 (11414).

Sphacelaria tribuloides Meneghini 1840: 2, No. 6 (Dalmatia); Vickers 1908, part 2, pl. 26; Børgesen 1941: 41, fig. 18a–c
Fig. 14*i*, *j*

LOCAL DISTRIBUTION: Forming dense tufts about 1 cm. high on non-coral rocks, Sta. 2 (11088).

Pocockiella variegata (Lamx.) Papenfuss 1943: 467, figs. 1–14. *Dictyota variegata* Lamouroux 1809*b*: 331 (Antilles). *Zonaria variegata* (Lamx.) C. Agardh 1817: xx
Fig. 14*k*

LOCAL DISTRIBUTION: Frequent on coral fragments in shallow water to 3 m., Sta. 1

FIG. 15. *Dictyota dichotoma:* Habit of part of a narrow and part of a broad form, × 1.

(11072). At Sta. 9 some closely adherent forms were found having a habit suggestive of *Ralfsia* (11320).

Dictyota dichotoma (Huds.) Lamouroux 1809*b*: 331; Okamura, Icones 3: 39, pls. 111–113; Dawson 1950*a*: 90. *Ulva dichotoma* Hudson 1762: 476 (England)
Fig. 15

LOCAL DISTRIBUTION: In drift, Sta. 3 (11093).

Dictyota friabilis Setchell 1926: 91, pl. 13, figs. 4–7, pl. 20, fig. 1 (Tahiti)
Fig. 16*a*, *b*

LOCAL DISTRIBUTION: Creeping, loosely adherent, and overlapping, on irregular surfaces of coral in 2–3 m., Sta. 2 (11389, 11361).

The variation in width and form shown by these two collections is in good accord with the type material from Tahiti. A few reproductive blades bear undivided sporangia on their ventral surfaces.

Dictyota patens J. Agardh 1882: 93 (warm seas: Virgin Islands and Friendly Islands); Okamura, Icones 3, pl. 104, figs. 1–11
Fig. 16*c*

LOCAL DISTRIBUTION: Scarce, Sta. 4 (11419). This material agrees well with the species as it is known in southern Japan and the Ryukyu Islands. However, Agardh's type material, including both Pacific and Caribbean specimens, has apparently not been reviewed by any recent authors.

Padina commersonii Bory 1828: 114 (Île

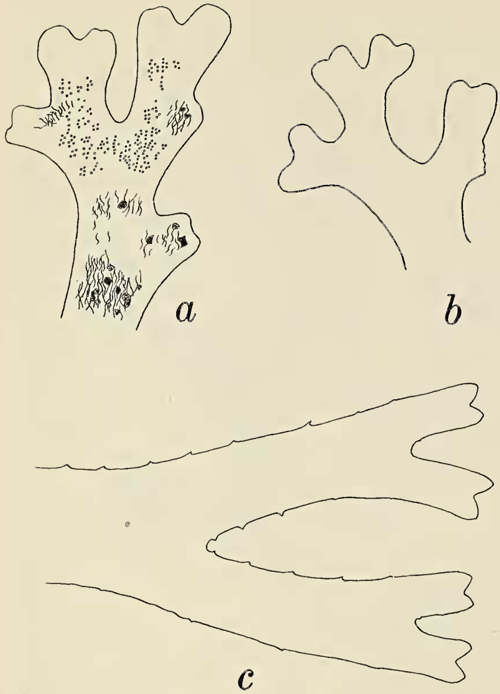

FIG. 16. *a*, *b*, *Dictyota friabilis: a*, A portion of a thallus of 11361, showing sporangia and rhizoids with sand grains on the ventral surface, × 2.5; *b*, outline of part of a sterile thallus of 11389, × 1. *c*, *Dictyota patens:* An upper portion of a plant to show apices and marginal teeth, × 2.3.

de France); Weber van Bosse 1913: 178, fig. 51; Børgesen 1930: 170
Fig. 17

LOCAL DISTRIBUTION: Small plants to 2 cm. tall from conspicuous "*Vaughaniella*" creeping parts, Sta. 1 (11128); large, flabellate plants to 20 cm. tall on rocks, Sta. 3, 4 (11163).

These plants have the fertile zones alternating with hair zones as is characteristic of this species according to Weber van Bosse.

Colpomenia sinuosa (Roth) Derbès and Solier 1856: 11, pl. 22, figs. 18–20. *Ulva sinuosa* Roth 1806: 327, pl. 12 (Cadiz, Spain)
Fig. 18*a*, *c*, *d*

LOCAL DISTRIBUTION: A number of different forms of this species occur, often intermingled in a given locality. In many respects they suggest different species, but experience in other regions has taught that the specimens representing this range of variability cannot satisfactorily be separated into specific units. The smooth, rounded form of Figure 18*a*, which may be considered the typical form of the species (forma *sinuosa*), is readily recognized by its brown, bubble-like shape. Figure 18*c*, *d* represent two examples from a considerable range of tuberculate, lobed, contorted, and perforated plants. The strongly lobed one of Figure 18*c* forms dense, more or less hemispherical thalli to 5–6 cm. in diameter which occur in abundance along the beach at Cù Lào. The part of a plant drawn is a variant with rather gross protruberances. Other examples have smaller, more compacted lobes. Figure 18*d* represents a form which tends to approach *Hydroclathrus* in its contorted form and perforated thallus. It is rather coarse in texture and has thicker walls than 11331, which is thin-walled and rather soft in texture. Although occasionally found elsewhere, all these forms occur in abundance in the shallow area just east of the village of Cù Lào during February.

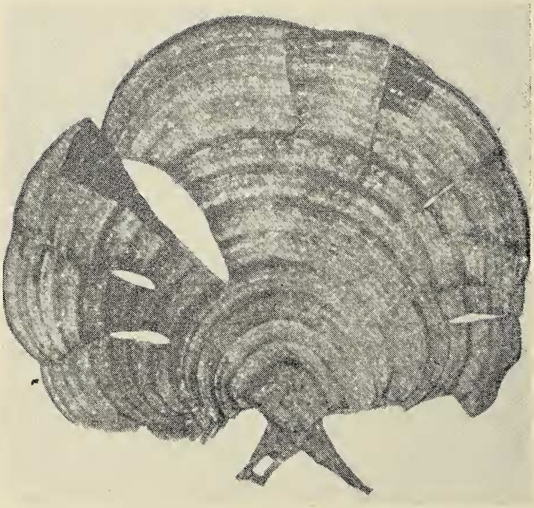

FIG. 17. *Padina commersonii:* A mature, fertile blade, × 0.9.

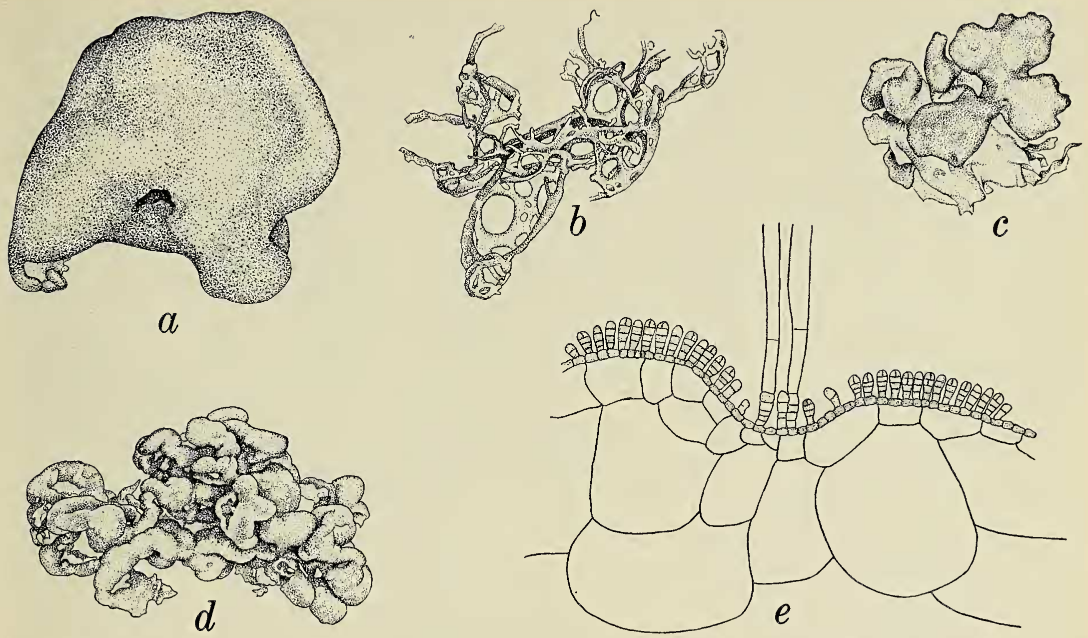

FIG. 18. *a*, *c*, *d*, *Colpomenia sinuosa: a*, Habit of a plant of 11330, × 1.5; *c*, portion of a hemispherical plant of 11331, × 1; *d*, habit of a plant of 11350, × 1.5. *b*, *Hydroclathrus clathratus:* A small portion of a reticulate plant, × 1.5. *e*, *Rosenvingea nhatrangensis:* Transection of a thallus through a sorus of plurilocular sporangia around a group of hairs, × 225.

Hydroclathrus clathratus (Ag.) Howe 1920: 590. *Encoelium clathratum* C. Agardh 1822: 412 (Belle Isle, France)
Fig. 18*b*

LOCAL DISTRIBUTION: In shallow water, Sta. 10 (11332); Sta. 4 (11425).

This species was rare and in young stages in January, but by mid-March had become fairly common and well developed in the Cau Da–Cua Be area.

Rosenvingea nhatrangensis sp. nov.
Figs. 18*e*, 19*b*

Thallo epiphytico, 4–6 cm. alto, ope rhizoidum multicellularum adnexo, cavo, membranaceo, molli, breviramato, lobato, partibus inferioribus ad 2.5–3 cm. diametro, ramis 2–4 cm. longis, 1.0–1.5 cm. latis, ramis brevibus ultimis lobisque 4–6 mm. latis, terminaliter rotundatis; sporangiis plurilocularibus crassiclavatis, 12–16 μ longis, in soris rotundatis fixis circiter 250 μ diametro, plerumque annulum crassum formantibus circum plures pilos e depressione exigua in superficie orientes.

Thallus epiphytic, 4–6 cm. high, attached by masses of multicellular rhizoids about 10 μ in diameter, hollow, soft, thin-walled, short-branched and lobed, the lower parts to 2.5–3 cm. in diameter, the branches 2–4 cm. long, 1.0–1.5 cm. wide, the ultimate short branches and lobes 4–6 mm. wide, terminally rounded; thallus wall 110–150 μ thick, consisting of a single surface layer of small, somewhat periclinally elongated, densely pigmented cells mostly 9–11 μ in length, and a subsurface tissue of thin-walled, irregularly rounded, colorless cells up to 100 μ in diameter; plurilocular sporangia thick-clavate, 12–16 μ long, borne in small, rounded sori about 250 μ in diameter usually forming a thick ring around a small group of hairs arising from a slight depression in the surface.

TYPE: Holotype is Dawson 11170, Jan. 30, 1953, in the U. S. National Herbarium.

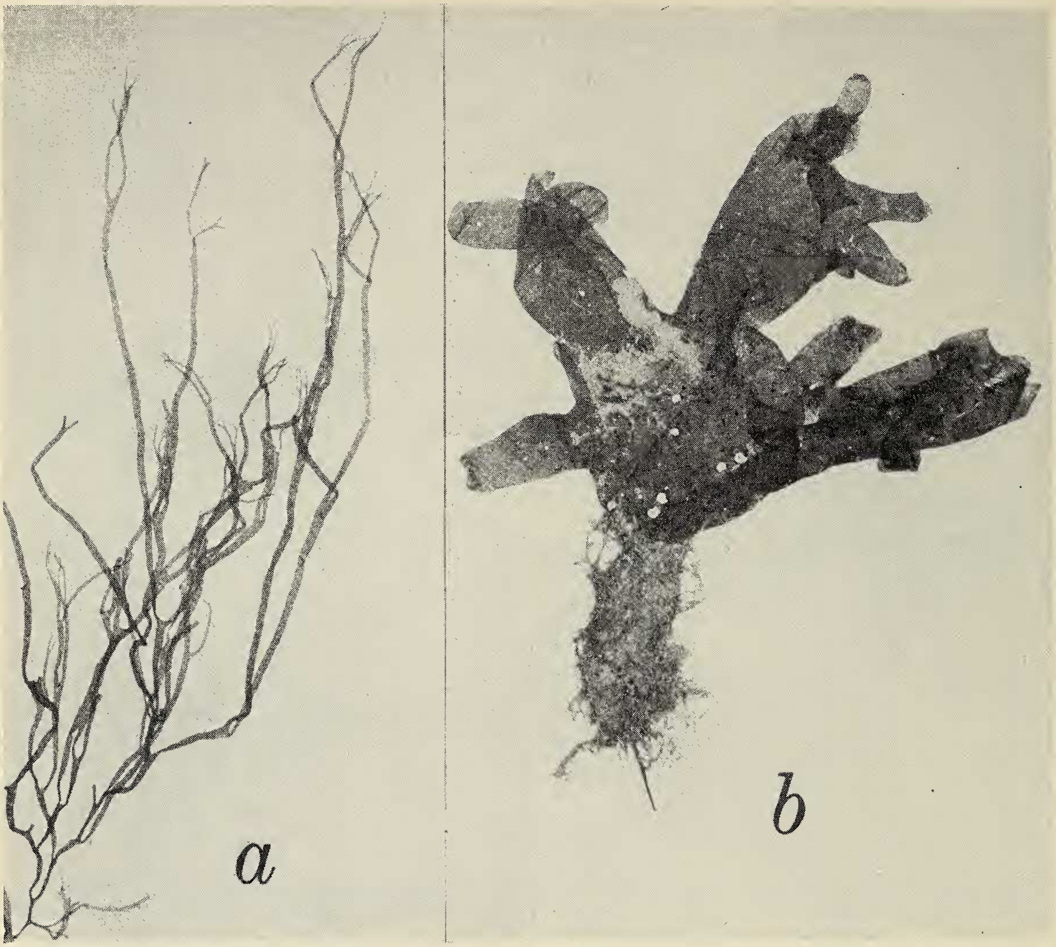

FIG. 19. *a*, *Rosenvingea orientalis:* Habit, × 1. *b*, *Rosenvingea nhatrangensis:* Habit, × 1.

Type Locality: Epiphytic on *Diplanthera* and on algae on the sand flats of Cua Be near Trủòng Dông.

Additional material: Same locality, Mar. 15, 1953, on a shell (11432).

This species is apparently most closely related to *Rosenvingea fastigiata* (Zanard.) Børg., especially to the variety *major* Reinb., which reaches a branch diameter of 5 mm. That species also has the sori in rings around hair groups, but its regular dichotomous branching and the equality of diameter throughout give it a very different aspect from the present, much-inflated, and lobed, short species.

Rosenvingea orientalis (J. Ag.) Børgesen 1914: 182; Børgesen 1930: 168. *Asperococcus orientalis* J. Agardh 1848: 78 (Manila, Philippines)

Fig. 19*a*

LOCAL DISTRIBUTION: Sta. 4 (11180); in drift, Sta. 3 (11091).

This species seems not to have been illustrated, and I have seen no authentic material. However, my plants agree with Agardh's description and with Børgesen's comments about the plant. The fine attenuation of the branch-apices is distinctive.

Chnoospora implexa Hering, ex J. Agardh 1848: 172 (Red Sea); Weber van Bosse 1913: 137; Yamada and Tanaka 1938: 67.

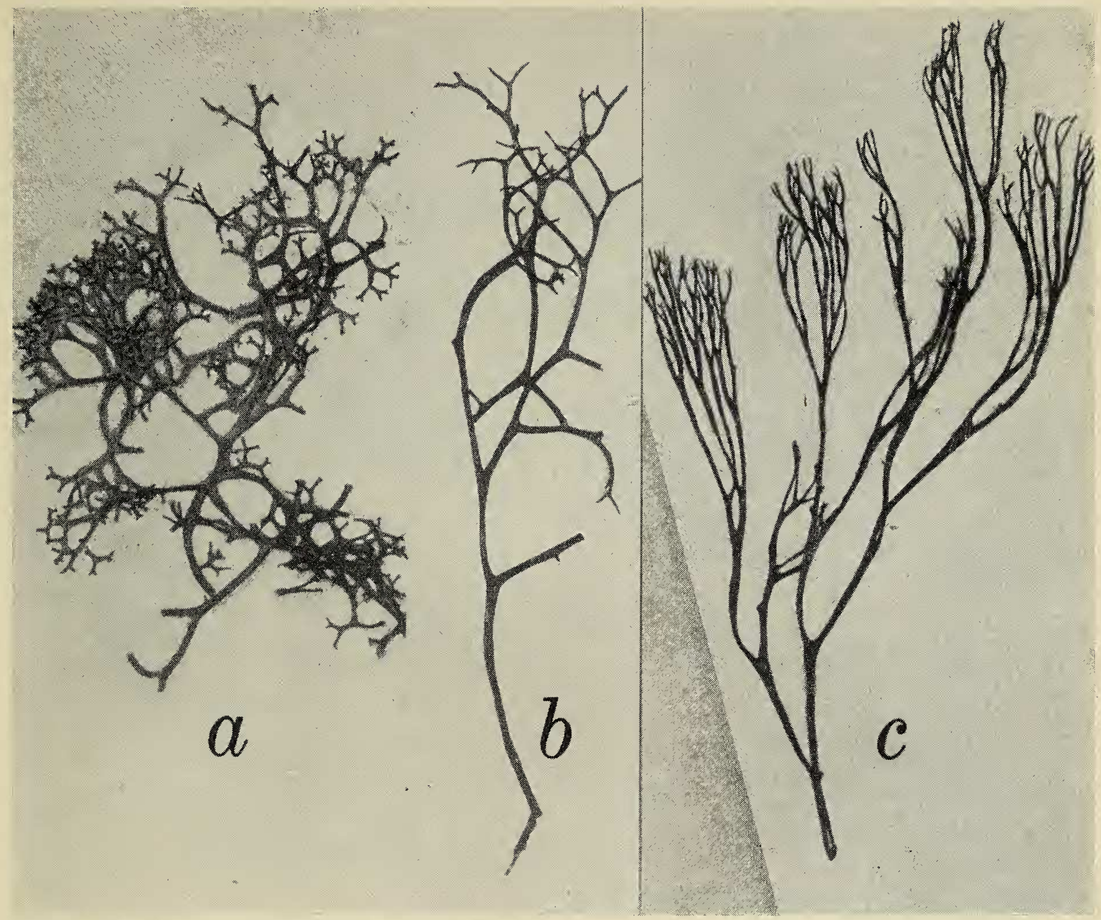

FIG. 20. *a*, *b*, *Chnoospora implexa:* Examples of both the lax and the more compact forms, × 0.95. *c*, *Chnoospora pacifica:* Habit of a plant of medium size, × 0.9.

Okamura 1918, Icones 4, pl. 164, figs. 1–9 (as *Chnoospora obtusangula*)
Fig. 20*a*, *b*

LOCAL DISTRIBUTION: Lax, to 30 cm. tall, in drift, Sta. 4 (11420); forming extensive, loose mats 10–12 cm. thick on coral fragments in shallow water, Sta. 13 (11433).

Chnoospora pacifica J. Agardh 1847: 7 (Pacific Mexico); Kützing, Tab. Phyc. 9, pl. 86; Taylor 1942: 51, pl. 9, figs. 1, 2; Yamada 1950: 189
Fig. 20*c*

LOCAL DISTRIBUTION: Abundant at middle levels, Sta. 8 (11273).

This material is in good agreement with the type specimens collected by Liebmann on the coast of Oaxaca, Mexico.

Turbinaria ornata (Turn.) J. Agardh 1848: 266. *Fucus turbinatus* var. *ornatus* Turner 1808: 50, pl. 24, figs, c, d (type locality unknown)
Fig. 21

LOCAL DISTRIBUTION: Forming dense colonies several decimeters across on rocks slightly exposed at lowest water, Sta. 1 (11135). These plants were young in January, reaching good development in March.

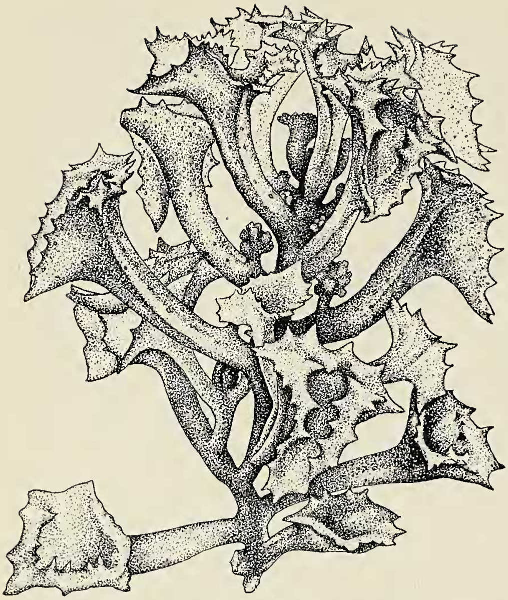

FIG. 21. *Turbinaria ornata:* Habit of a plant exclusive of base and attachment stolons, × 1.5.

Key to the Species of *Sargassum*

1. "Leaves" coarse, thick, + − fleshy, at least below, about two thirds as broad as long.................. **S. crassifolium**

   "Leaves" not thick or fleshy, mostly more than twice as long as broad...........2

2. Vesicles with prominent foliose margins .... **S. mcclurei**

   Vesicles smooth, apiculate or bearing spines, but without foliose margins....3

3. Vesicles about 1.5 cm. long; axes flat, at least in part................... **S. sp. 2**

   Vesicles all less than 1 cm. long; axes + − cylindrical throughout..........4

4. "Leaves" mostly linear...............5

   "Leaves" not linear..................6

5. Vesicles elongate, apiculate, without spines .... **S. sp. 4**

   Vesicles + − rotund, not apiculate, sometimes bearing spines........... **S. sp. 1**

6. Attached by ramified stolons........... .... **S. polycystum**

   Attached by a discoid or cone-shaped holdfast..........................7

7. "Leaves" with abundant, fine, sharp teeth; vesicles elongate, apiculate...... **S. sp. 3**

   "Leaves" with irregular, coarse or blunt teeth; vesicles rotund, not apiculate but often bearing teeth........... **S. sandei**

Sargassum polycystum C.Agardh 1824: 304 (Sunda Straits); Yamada 1942*a*: 376, figs. 5, 6; Yamada 1950: 193

Fig. 22*t*, *u*

LOCAL DISTRIBUTION: On rocks, Sta. 3 (11167); in drift, Sta. 11 (11351).

The production of creeping stolons from the base of this species is distinctive.

Sargassum mcclurei Setchell 1933: 45, pl. 19 (Hong Kong)

Fig. 22*k–o*

LOCAL DISTRIBUTION: Drift, Sta. 11 (11360); drift, Sta. 2 (11423).

Sargassum crassifolium J. Agardh 1848: (Tropical Africa and Southwest Pacific) 326; Yamada 1942*b*: 511, fig. 14.

Fig. 22*f*

LOCAL DISTRIBUTION: Exposed rocks, Sta. 10 (11345).

Sargassum sandei Reinbold, in Weber van Bosse 1913: 158, fig. 47, pl. 4 (Flores Island, Indonesia)

Fig. 22*r*, *s*

LOCAL DISTRIBUTION: On outer rocks, Sta. 11 (11416).

Sargassum sp. 1

Fig. 22*g*, *h*

LOCAL DISTRIBUTION: In drift, Sta. 2 (11359), about 3 meters long.

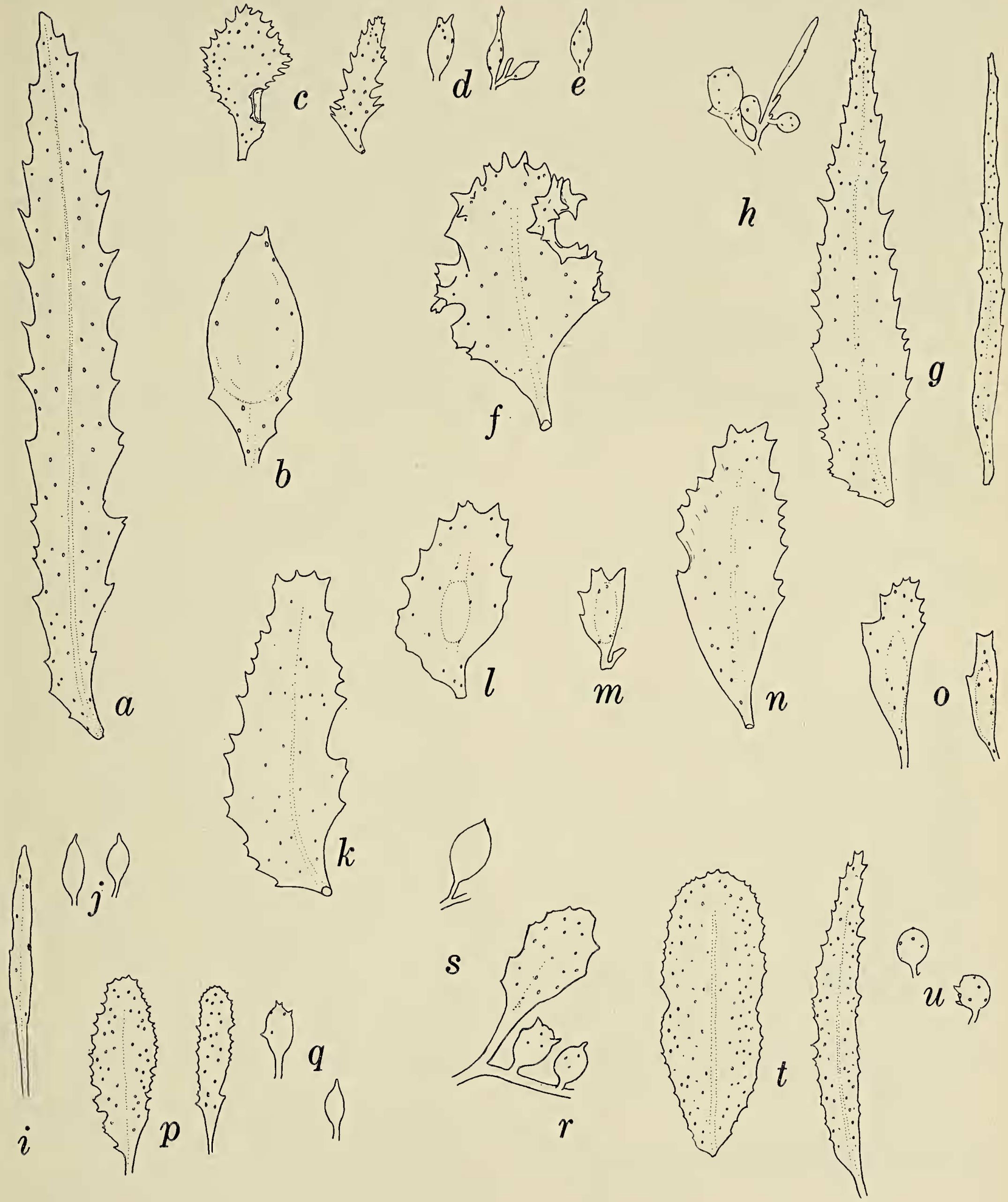

FIG. 22. (All drawings × 1.5) *a*, *b*, *Sargassum* sp. 2: *a*, A "leaf"; *b*, a vesicle. *c–e*, *Sargassum* sp. 3: "Leaves" and vesicles showing variation. *f*, *Sargassum crassifolium:* A duplicate "leaf" from a young plant. *g*, *h*, *Sargassum* sp. 1: *g*, Two "leaves," the broader form being of infrequent occurrence; *h*, vesicles. *i*, *j*, *Sargassum* sp. 4: "Leaf" and vesicles. *k–o*, *Sargassum mcclurei: k–m*, "Leaf" and two vesicles from 11423; *n*, *o*, "leaf" and two vesicles from 11360. *p*, *q*, *Sargassum* sp. 3: "Leaves" and vesicles showing variation (compare with *c*, *d*, *e*). *r*, *s*, *Sargassum sandei:* "Leaf" and vesicles. *t*, *u*, *Sargassum polycystum:* "Leaves" and vesicles.

Dr. Yamada believes this is an undescribed species but does not venture to name it inasmuch as the specimen is incomplete.

Sargassum sp. 2
Fig. 22*a*, *b*

LOCAL DISTRIBUTION: In drift, Sta. 2 (11358); also observed in drift on the seaward shore of Île de Tre.

Sargassum sp. 3
Fig. 22*c–e*, *p*, *q*

LOCAL DISTRIBUTION: On rocks, Sta. 3 (11168), Sta. 10 (11346).

Sargassum sp. 4
Fig. 22*i*, *j*

LOCAL DISTRIBUTION: In drift, Sta. 11 (11352).

RED ALGAE

Key to the Genera of *Rhodophyta*

1. Thallus calcified, at least in part....... 2
   Thallus uncalcified................ 16
2. Thallus crustose.................. 3
   Thallus not crustose, the erect parts branched, free.................... 10
3. Tetrasporangia borne in nemathecial sori .... **Peysonnelia** (in part)
   Tetrasporangia borne in enclosed conceptacles.......................... 4
4. Thallus monostromatic or essentially so 5
   Thallus polystromatic.............. 6
5. Epiphytic, prostrate; conceptacles 150–200 μ in diameter............ **Fosliella**
   Not epiphytic, partially free; conceptacles 1 mm. or more in diameter. **Lithoporella**
6. Roof of sporangial conceptacles perforated by few to many pores............ .... **Lithothamnium**
   Roof of sporangial conceptacles perforated by a single pore............... 7
7. Heterocysts present and prominent..... .... **Hydrolithon**
   Heterocysts absent or obscure........ 8
8. Thallus a simple crust 150–2,500 μ thick 9
   Thallus with prominent excrescences or branches ...... **Lithophyllum** (in part)
9. Sporangial conceptacles 500–600 μ in diameter............ **Neogoniolithon**
   Sporangial conceptacles 100–130 μ in diameter....... **Lithophyllum** (in part)
10. Calcification discontinuous, the thallus jointed......................... 11
    Calcification complete or incomplete but not discontinuous; thallus not jointed 12
11. Conceptacles terminal; segments less than 225 μ in diameter.......... **Jania**
    Conceptacles lateral; segments over 250 μ in diameter.............. **Amphiroa**
12. Thallus flabellate........ **Titanophora**
    Thallus cylindrical to ligulate....... 13
13. Thallus calcified very lightly only at the base.................. **Dermonema**
    Thallus lightly to heavily calcified throughout except at young tips.... 14
14. Thallus soft, + – lubricous..**Liagora**
    Thallus + – rigid, not lubricous.... 15
15. Thallus provided with whorls of filaments extending from the cortex............ .... **Actinotrichia**
    Thallus smooth, or, if extended filaments

present, these not in whorls .... **Galaxaura**

16. Thallus crustose 17

Thallus not crustose 18

17. Tetrasporangia in sunken conceptacles .... **Hildenbrandia**

Tetrasporangia in nemathecial sori .... **Peysonnelia** (in part)

18. Free thallus parts consisting of a single row of cells 19

Free thallus parts consisting of more than a single row of cells 27

19. Filaments unbranched .... **Erythrotrichia**

Filaments branched 20

20. Cell cavity less than half the diameter of the gelatinous filament ... **Asterocystis**

Cell cavity much greater in diameter than wall thickness 21

21. Cells of subultimate segments over 160 μ in diameter .... **Griffithsia**

Cells of subultimate segments less than 100 μ in diameter 22

22. Branching opposite or verticillate, at least below 23

Branching alternate or irregular 24

23. Tetrasporangia surrounded by curved, involucral filaments .... **Wrangelia**

Tetrasporangia not associated with curved filaments .... **Antithamnion**

24. Cells of main axes over 50 μ in diameter 25

Cells of main axes less than 20 μ in diameter .... **Acrochaetium**

25. Branches spirally arranged from a percurrent axis 26

Branches sparse, not spirally arranged .... **Neomonospora**

26. Sporangia to 150 μ in diameter, undivided, encircled by slender involucral filaments .... **Callithamnion?**

Tetrasporangia to 50 μ in diameter, free .... **Mesothamnion**

27. Thallus complanate and membranous, at least in part 28

Thallus cylindrical, compressed or flattened but not membranous 32

28. Thallus membranous throughout 29

Thallus consisting of a subcylindrical, prostrate axis bearing membranous, leaf-like blades .... **Leveillea**

29. Growing by means of an apical cell 30

Growing by means of a marginal meristem 31

30. Branches arising from the midrib .... **Hypoglossum**

Branching subdichotomous . **Caloglossa**

31. Thallus monostromatic .... **Porphyra**

Thallus consisting of several layers of cells and filaments .... **Halymenia**

32. Thallus uniaxial, a single apical cell distinguishable at least in young, growing parts 33

Growth by means of a marginal, terminal, or intercalary meristematic region 55

33. Thallus furry, consisting of a densely corticated axis bearing abundant, uniseriate hairs 34

Not as above 35

34. Branching dichotomous .... **Dasyopsis**

Branching multifarious .... **Dasya**

35. A central axial filament readily observed

in transverse or longi-section of mid-parts 36

A central axial filament + – obscure or not detectable in sections of mid-parts 47

36. Thallus essentially cylindrical throughout 37

Thallus flat, at least in part . . **Taenioma**

37. Thallus with slender, elongate axes . . 38

Thallus consisting of stipitate, obpyriform branches . . . . **Acrocystis**

38. Thallus consisting of segments, each with a whorl of teeth around the upper end . . . . **Centroceras**

Not as above 39

39. Filaments consisting of the central axial cells and a cortex which is discontinuous and in the form of bands, at least in young parts or branches 40

Not as above 41

40. Cortication continuous in main axes, discontinuous in lateral branchlets . . . . **Spyridia**

Cortication essentially the same in branches of different orders . . **Ceramium**

41. Thallus densely corticated with small cells . . . . **Acanthophora**

Thallus with a single tier of cells surrounding the central axial filament . . . 42

42. Pericentral cells 3 . . . . **Falkenbergia**

Pericentral cells 4 or more 43

43. Axes provided with dense, spirally arranged, coarsely spinulose short branchlets . . . . **Tolypiocladia**

Not as above 44

44. Pericentral cells equal to the axial cells in length 45

Pericentral cells half the length of axial cells . . . . **Bostrychia**

45. Indeterminate branches alternating with groups of determinate branches . . . . **Herposiphonia**

All branches essentially indeterminate 46

46. Erect filaments arising from extensive prostrate, creeping filaments . . . . **Lophosiphonia**

Without extensive, prostrate filaments . . . . **Polysiphonia**

47. Apical cell surrounded by short trichoblasts 48

Apical cell not surrounded by trichoblasts 52

48. Apical cell in a terminal depression . . . 49

Apical cell emergent . **Chondria** (in part)

49. Thallus cylindrical 50

Thallus flat 51

50. Ultimate branchlets very short . . . . **Laurencia** (in part)

Ultimate branches not very short . . . . **Chondria** (in part)

51. Branching all in one plane . . . . **Laurencia** (in part)

Branching partly multifarious . . . . **Chondria** (in part)

52. Thallus with slender, rhizoidal filaments among the medullary cells 53

Thallus without rhizoidal filaments . . 54

53. Cystocarps unilocular . . . . . **Pterocladia**

Cystocarps bilocular . . . . **Gelidium**

54. Axes provided with numerous short branchlets equally distributed on all sides . . . . **Hypnea**

Axes without numerous small branchlets, or at least these not equally distributed on all sides . . . . **Gelidiella**

55. Lower parts uniseriate; growth intercalary . . . . **Goniotrichum**

Lower parts not uniseriate; growth not intercalary 56

56. Thallus hollow, with regular transverse diaphragms . . . . **Champia**

Thallus not hollow, or at least without diaphragms 57

57. Growing with and resembling a sponge . . . . **Ceratodictyon**

Not as above 58

58. Creeping on mangrove roots; constricted as if jointed . . . . **Catenella**

Not as above 59

59. Thallus in transection showing a medulla of loosely interlaced filaments 60

Medulla without loosely interlaced filaments 61

60. Thalli caespitose, the segments arching . . . . **Gigartina**

Thalli not caespitose, erect **Grateloupia**

61. Branching dichotomous 62

Branching not dichotomous 63

62. Segments to 3 mm. wide, with + − frequent proliferous branchlets . . . . **Carpopeltis**

Segments under 2.5 mm. wide, without frequent proliferous branchlets . . . . **Gymnogongrus**

63. Axes 250 μ or less in diameter 64

Axes mostly 1 mm. in diameter or more 65

64. Tetrasporangia and antheridia borne in swollen, terminal stichidia . **Gelidiopsis**

Not as above . . . . **Wurdemannia**

65. Cystocarps with nutritive filaments extending from gonimoblast to pericarp . . . . **Gracilaria**

Cystocarps without special nutritive filaments . . . . **Gracilariopsis**

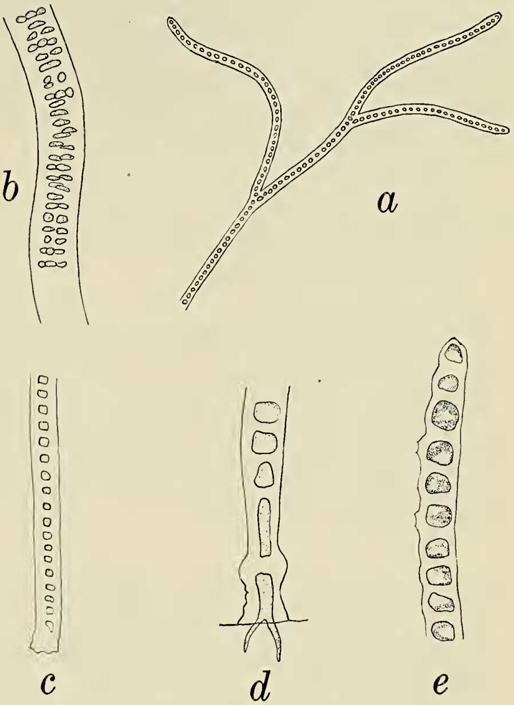

FIG. 23. *a*, *Asterocystis ornata:* Part of a filament 17–20 μ in diameter, × 73. *b*, *c*, *Goniotrichum humphreyi: b*, Upper portion of a filament, × 185; *c*, basal portion of a filament, × 233. *d*, *e*, *Erythrotrichia parietalis: d*, Lower portion of filament showing penetrating basal cell and thick, swollen wall at the base, × 600; *e*, upper portion of a filament showing parietal chromatophores. × 350.

Asterocystis ornata (Ag.) Hamel 1924: 451, fig. 7b–e; Tanaka 1952: 11, fig. 6. *Conferva ornata* C. Agardh 1824: 104 (Europe)
Fig. 23*a*

LOCAL DISTRIBUTION: A minute epiphyte on various small algae such as *Tolypiocladia* from Sta. 4 (11156a) and *Wurdemannia* from Sta. 2 (11185).

Goniotrichum humphreyi Collins 1901: 251 (Jamaica); Tanaka 1952: 8, fig. 4
Fig. 23*b*, *c*

LOCAL DISTRIBUTION: Growing with *Enteromorpha* on upper rocks, Sta. 10 (11328).

This plant consists of a slender, unbranched or slightly branched filament which is uniseriate at the base and attached by a slight enlargement of the gelatinous base of the filament, either with or without enlargement of the cavity of the lowermost cell. The filaments are about 15 μ in diameter near the base and 30–35 μ thick above.

Erythrotrichia parietalis Tanaka 1952: 18, fig. 10a–e (Hyuga Prov., Japan)
Fig. 23*d*, *e*

LOCAL DISTRIBUTION: Epiphytic on *Hypnea esperi* from coral rocks, Sta. 2 (11079).

My material corresponds closely with Tanaka's figures of this newly described plant. The parietal chromatophore and the penetrating basal cell are distinctive. The filaments are about 10–20 μ in diameter.

Porphyra crispata Kjellman 1897: 15, pl. 1, figs. 4, 5, pl. 3, figs. 5, 6, pl. 5, fig. 15 (Japan); Tanaka 1952: 34, pl. 4, figs. 2, 3, text fig. 17A–Q
Fig. 24

LOCAL DISTRIBUTION: Epiphytic on *Gymnogongrus*, Sta. 6 (11220).

My plants are sterile but up to 2.5 cm. tall and in full agreement vegetatively with this species known from Formosa and the Ryukyu Islands. The thallus is monostromatic and provided with minute marginal teeth. The species is said to grow on rocks in Japan.

Key to the Species of *Acrochaetium*

1. Basal attachment by a single cell. . . . . **A. robustum**

   Basal attachment by several to many cells 2

2. Basal cells at least partially penetrating the host 3

   Basal cells not penetrating the host. . . . 4

3. On *Liagora*; attached by penetrating filaments . . . . **A. occidentale**

   On *Pterocladia*; attached by a disc with only slightly penetrating cells. . . . . **A. subseriatum**

4. About 200 μ high; monospores unilateral . . . . **A. sancti-thomae**

   To 1.2 mm. high; monospores multifarious . . . . **A. gracile**

FIG. 24. *Porphyra crispata:* Habit, × 0.9.

Acrochaetium sancti-thomae Børgesen 1915: 30, figs. 23, 24 (Virgin Islands on *Sargassum*)
Fig. 25*a–c*

LOCAL DISTRIBUTION: On *Chaetomorpha antennina*, Sta. 8 (11265).

These plants reach a little over 200 μ in height and are in good accord with this West Indian species. In habit they are particularly like Børgesen's figure 23c. The filaments, however, are somewhat more slender (about 6 μ) than described for this species (8–9 μ). Hairs are common. Although not mentioned by Børgesen, germinating spores show a division into two cells which remain distinct for a time from other cells of the basal filaments, as in *Kylinia pulchellum* and *K. dubosquii*. Un-

FIG. 25. *a–c*, *Acrochaetium sancti-thomae: a*, A germinating spore and a young plant consisting only of prostrate filaments, × 425; *b*, a somewhat older plant in lateral view, × 280; *c*, a mature, erect filament with monospores, × 263. *d*, *e*, *Acrochaetium occidentale: d*, Lower part showing penetrating filaments beside an antheridial filament of *Liagora farinosa*, × 117; *e*, upper part bearing monospores, × 196. *f*, *g*, *Acrochaetium subseriatum: f*, Upper part bearing monospores, × 95; *g*, basal part showing partially penetrating cells, × 280. *h*, *i*, *Acrochaetium gracile: h*, Upper part bearing monospores, × 183; *i*, basal attachment to host, × 235. *j*, *k*, *Acrochaetium robustum: j*, Upper part bearing monospores, × 275; *k*, basal part with specialized attachment cell, × 325. *l*, *Falkenbergia hillebrandii:* A terminal portion of a filament, × 117. *m*, *Dermonema frappieri:* Habit of part of a clump, × 2.

doubtedly this character is more conspicuous against the translucent membrane of *Chaetomorpha* than against the dark surface tissue of *Sargassum*. The chromatophores are distinctly parietal.

Acrochaetium occidentale Børgesen 1915: 44, figs. 42, 43 (Virgin Islands)
Fig. 25*d*, *e*

LOCAL DISTRIBUTION: Forming a silky pile about 1.5 mm. long on *Liagora* at Sta. 1 (11121).

This material is identical with the West Indian species except that only monospores have been detected thus far.

Acrochaetium subseriatum Børgesen 1932*a*: 118, figs. 6, 7 (South India); Børgesen 1942: 15, fig. 6
Fig. 25*f*, *g*

LOCAL DISTRIBUTION: Forming small tufts 1.5–2 (or sometimes to 6) mm. high on *Pterocladia*, Sta. 6 (11221).

My material is apparently more luxuriantly developed than Børgesen's scant original specimens from the Gulf of Mannar, or those from Mauritius, but they are otherwise in full agreement. The main axes are about 8 μ in diameter and the monospores 12–13 μ long.

Acrochaetium gracile Børgesen 1915: 26, figs. 19, 20 (Virgin Islands)
Fig. 25*h*, *i*

LOCAL DISTRIBUTION: Forming a fine fur about 0.9–1.2 mm. long on the surface of old *Diplanthera* leaves in drift, Sta. 3 (11105); in small tufts 0.6–0.7 mm. high on *Gelidiella*, Sta. 4 (11341a).

The material under 11341a is in close agreement with Børgesen's account of the West Indian plant. That under 11105 is about 30 per cent larger in all dimensions.

Acrochaetium robustum Børgesen 1915: 40, figs. 38–40 (Virgin Islands); Børgesen 1920: 449, fig. 418; Tseng 1945: 158, pl. 1, figs. 2–4; Abbott 1947: 203, fig. 4
Fig. 25*j*, *k*

LOCAL DISTRIBUTION: Abundantly epiphytic on *Sargassum*, forming a fine, reddish, velvet-like covering over nearly all parts of old fronds, Sta. 3 (11174); Sta. 10 (11347).

These plants are up to 2 mm. high. The filaments are mostly 6–10 μ in diameter. *A. sargassicola* Børgesen (1932*a*: 115, figs. 3–5) from Bombay, India, does not seem to be distinct from *A. robustum*. See also Papenfuss (1945: 317) as to *A. lauterbachii* (Schmitz & Heydrich) Hamel.

Falkenbergia hillebrandii (Bornet) Falkenberg = sporophyte generation of *Asparagopsis taxiformis* (Delile) Collins and Hervey. Feldmann and Feldmann 1942: 89; Dawson 1953: 57. *Polysiphonia hillebrandii* Bornet, in Ardissone 1883: 376 (Italy)
Fig. 25*l*

LOCAL DISTRIBUTION: Epiphytic in small, loose tufts and scattered filaments on algae, Sta. 10 (11324).

No specimens of *Asparagopsis* have yet been found in the Nha Trang area, and the specific identity of this sporophyte generation of a species of that genus is therefore in doubt. It is tentatively referred here to the widespread, tropical *A. taxiformis*.

Dermonema frappieri (Mont. & Millard.) Børgesen 1942: 42, fig. 21. *Gymnophloea gracilis* Martens 1866: 146. *Cladosiphon frappieri* Montagne and Millardet 1862: 20, pl. 26, fig. 1 (Réunion Island). Tseng 1945: 159, pl. 1, figs. 5, 6 (as *Dermonema gracilis*)
Fig. 25*m*

LOCAL DISTRIBUTION: Growing in dense, erect tufts 4–5 cm. high, Sta. 8 (11272).

The illustration of the type given by Børgesen is in close agreement with the Nha Trang specimens. His notes from Jadin on the habitat in Mauritius, and those of Tseng

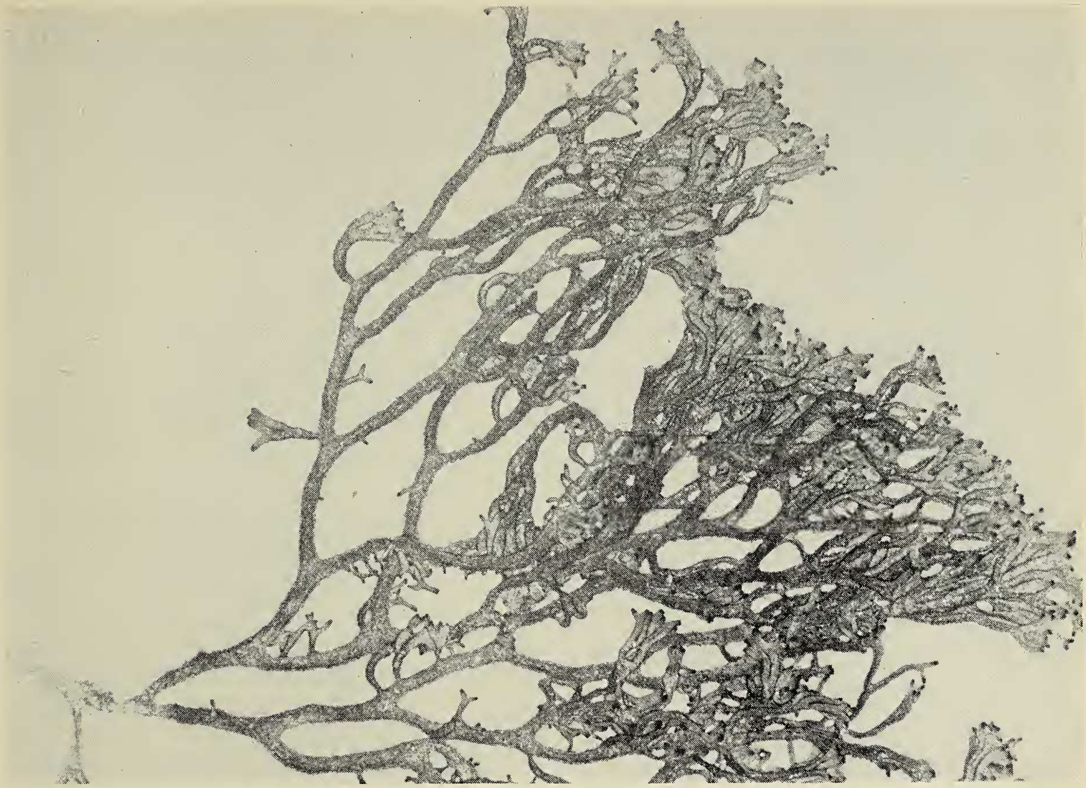

FIG. 26. *Liagora farinosa:* Habit, × 1.

for Hong Kong, are also in accord with the conditions under which this plant grows in Nha Trang Bay. Tseng says it is a spring annual, disappearing by the end of May.

Key to the Species of *Liagora*

1. Branching + − dichotomous 2

   Branching monopodial . . . . . **L. orientalis**

2. Thalli 15–20 cm. high; antheridia densely capitate . . . . **L. farinosa**

   Thalli 4–5 cm. high; antheridia not capitate 3

3. Apices not tapered; thallus moderately calcified, appearing mealy . **L. ceranoides**

   Apices somewhat tapered; thallus rather heavily calcified, + − smooth . . . . **L. divaricata**

Liagora farinosa Lamouroux 1816: 240 (Red Sea); Yamada 1938: 23, pls. 8–10, text figs. 15, 16; Dawson 1953: 43, pl. 2, figs. 9–12, pl. 14, fig. 1

Figs. 25*d*, 26

LOCAL DISTRIBUTION: On coral fragments, Sta. 1 (11110).

Liagora divaricata Tseng 1941: 269, figs. 2–4 (Hainan Island); Abbott 1945: 155, fig. 7

Fig. 27*a*

LOCAL DISTRIBUTION: On coral fragments, Sta. 1 (11109); Sta. 10 (11337).

Liagora orientalis J. Agardh 1896: 99 (Ceylon); Dawson 1953: 40, pl. 17, fig. 1. *Liagora formosana* Yamada 1938: 32, pls. 14, 15, text figs. 21, 22; Tseng 1941: 275, fig. 7

Fig. 27*b*

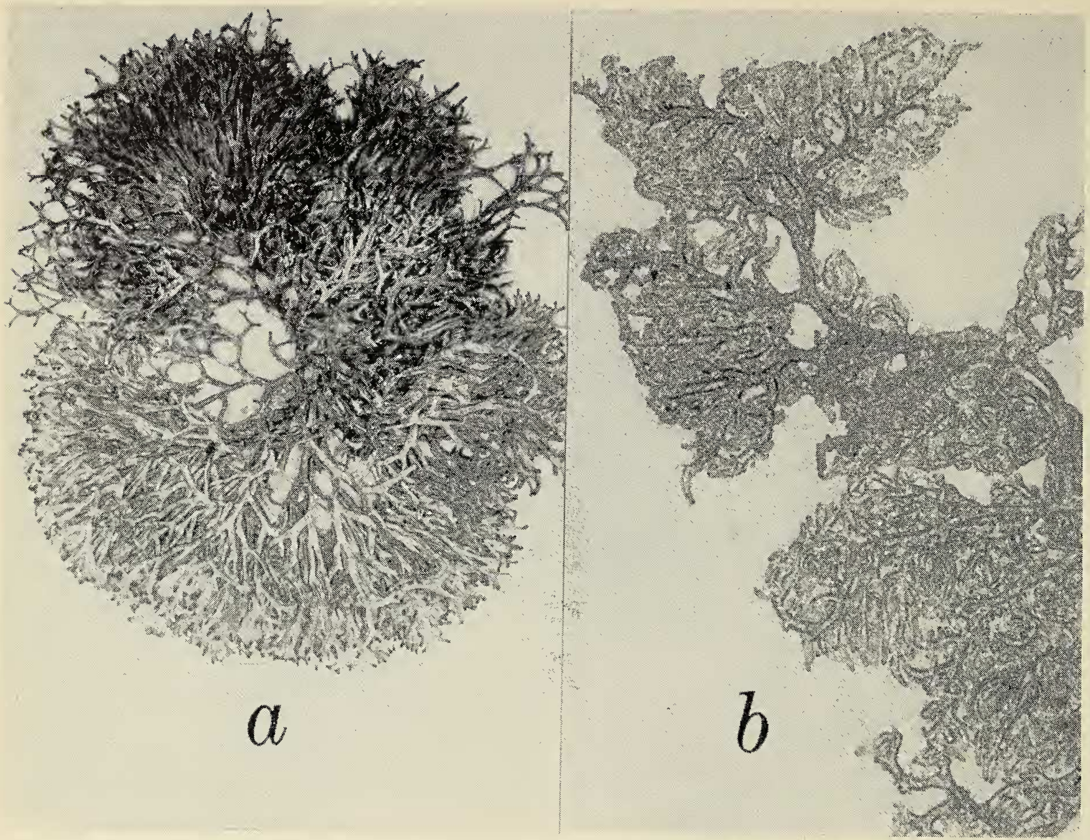

FIG. 27. *a, Liagora divaricata:* Habit, × 0.9. *b, Liagora orientalis:* Habit of part of a plant, × 1.

LOCAL DISTRIBUTION: On coral fragments, Sta. 1 (11111).

Liagora ceranoides Lamouroux 1816: 239 (Virgin Islands); Tseng 1941: 271, fig. 5; Yamada 1938: 20, pl. 6

Fig. 28*a*

LOCAL DISTRIBUTION: On coral fragments, Sta. 1 (11108); Sta. 2 (11447).

Actinotrichia fragilis (Forsk.) Børgesen 1932*b*: 6, pl. 1, fig. 4. *Fucus fragilis* Forskål 1775: 190 (Red Sea). *Actinotrichia rigida* (Lamx.) Decaisne 1842: 118

Fig. 28*b*

LOCAL DISTRIBUTION: Scarce, forming loose, wiry clumps about 2.5 cm. high on coral heads from 2–3 m., Sta. 2 (11388); at Cù Lào, May 4, 1950 (coll. R. Serene).

Key to the Species of *Galaxaura*

1. Thallus strongly flattened . . . . **G. vietnamensis**

Thallus cylindrical 2

2. Thallus smooth, without extended assimilatory filaments . . . . **G. fastigiata**

Extended assimilatory filaments present over entire thallus 3

3. Assimilatory portion homogeneous, composed only of extended assimilatory filaments . . . . **G. filamentosa**

Assimilatory portion heterogeneous, composed of both extended and short assimilatory filaments . . . . **G. fasciculata**

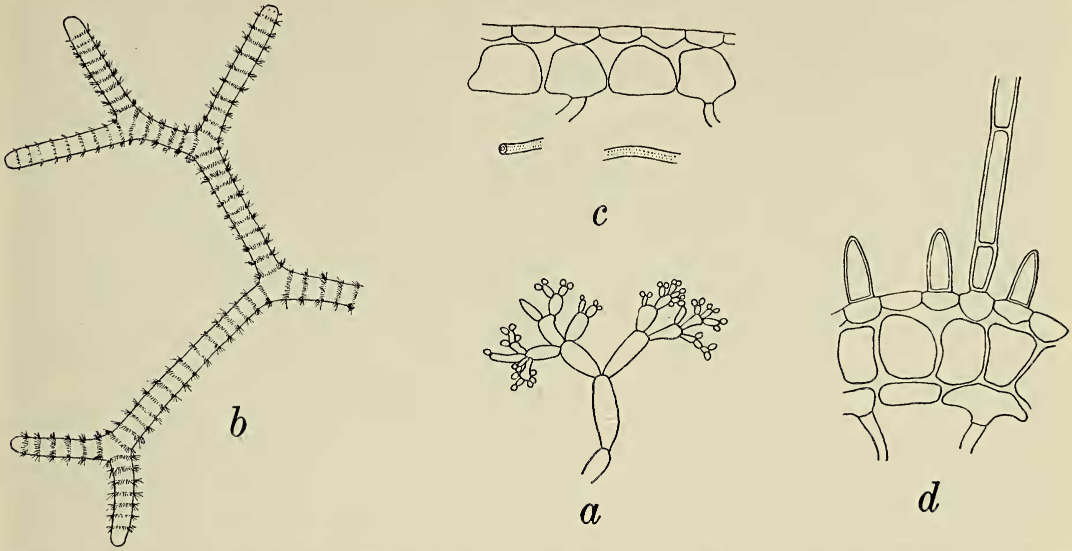

FIG. 28. *a*, *Liagora ceranoides:* An assimilatory filament bearing antheridia, × 400. *b*, *Actinotrichia fragilis:* An upper portion of a plant, × 7.5. *c*, *d*, *Galaxaura vietnamensis: c*, A small portion of the cortex from the flattened face of a blade, × 225; *d*, a small portion of the cortex from the margin, cut through a fascicle of extended assimilatory filaments with their associated spinulose cells, × 250.

Galaxaura vietnamensis sp. nov.
Figs. 28*c*, *d*, 29*a*

Thallo typi sexualis, ad 9 cm. alto, e stipite brevi, gracili, velutino, laminas complanatas cuneate edente; ramificatione in una planitie angulis angustis, intervallis 8–19 mm.; laminis 3.5–4.5 mm. latis, tenuibus, marginibus ad 350–400 μ, integris, haud constrictis, plene calcificatis, plus minusve nitentibus, apicibus obtusis, rotundis; cortice plerumque distromatico; cellulis subepidermalibus rotundis hemisphaericalibusque, 23–35 μ diametro; cellulis epidermalibus angularibus in aspectu superficiali, circiter 18 μ diametro; cellulis spinulosis solum ad margines, plerumque in fasciculis parvis filamentorum assimilativorum extensorum aggregatis.

Thallus of sexual type, to 9 cm. high, consisting of a simple or forked, terete, velvety stipe about 1.2 mm. in diameter and 2 mm. long giving rise cuneately to the complanate blades; branching in one plane at narrow angles, at intervals of 8–19 mm.; blades 3.5–4.5 mm. wide, thin, the margins thickened to 350–400 μ, entire, unconstricted, fully calcified and + — nitent, not striate, the apices blunt and rounded, scarcely tapered; cortical tissue mostly distromatic, partly tristromatic at the margins; subepidermal cells rotund-hemispherical, 23–35 μ in diameter; epidermal cells angular in surface view, about 18 μ in diameter; spinulose cells only at the margins, usually aggregated among small groups of extended assimilatory filaments; reproduction not seen.

TYPE: Holotype is a collection by Raoul Serene, April, 1950, in the U. S. National Herbarium.

Type locality: Dredged from 33 meters off the north side of "Black Rocks," Sta. 8.

This is one of the broadest of *Galaxaura* species, being most similar in this respect to *G. magna* Kjellm. from Cape Agulhas, South Africa. It differs from that species in its somewhat more flabellate branching at shorter intervals, its distinctly thickened margins, its usually distromatic cortical tissue, and the presence of groups of spinulose cells mixed

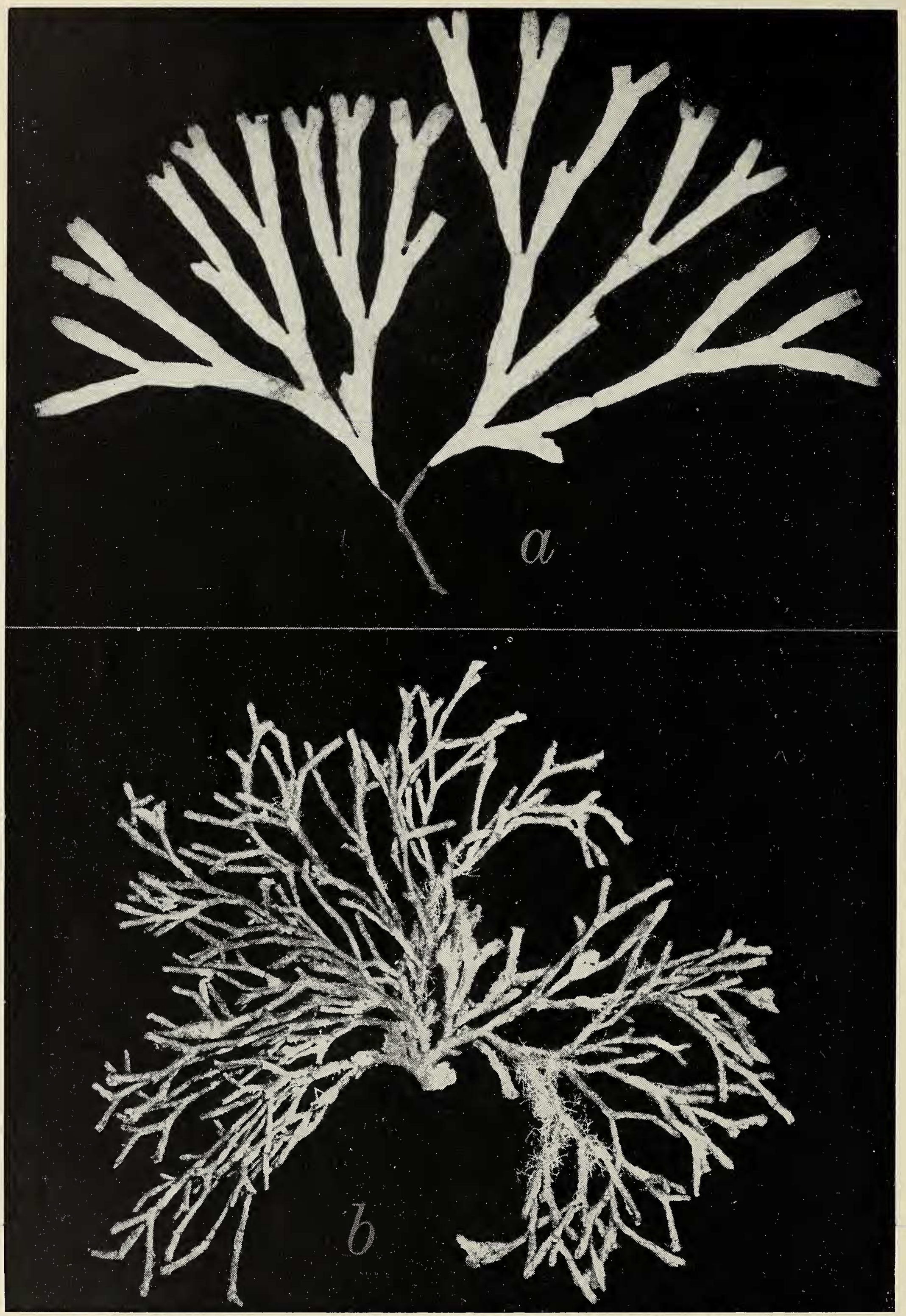

FIG. 29. *a*, *Galaxaura vietnamensis:* Habit of the type, × 1. *b*, *Galaxaura fasciculata:* Habit, × 1.

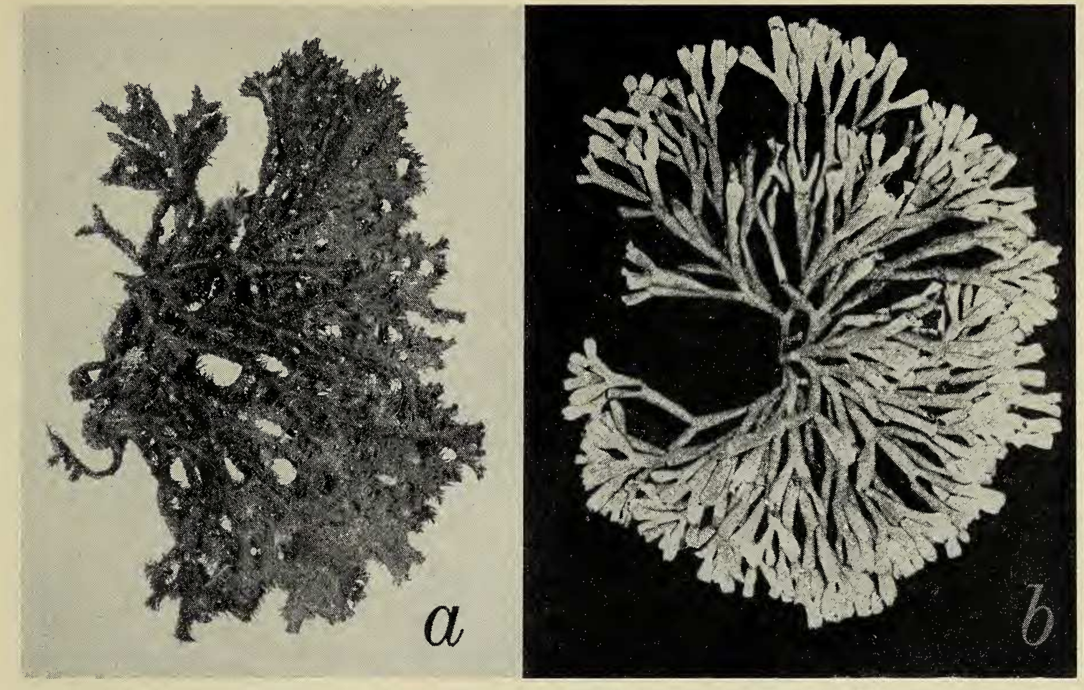

FIG. 30. *a*, *Galaxaura filamentosa:* Habit of a specimen of the type collection, × 1. *b*, *Galaxaura fastigiata:* Habit, × 1.1.

with fascicles of extended assimilatory filaments along the margins.

Galaxaura fasciculata Kjellman 1900: 53, pl. 5, fig. 1–9, pl. 20, fig. 14 (Celebes Island); Chou 1945: 44, pl. 2, fig. 2, pl. 8, fig. 1; Tanaka 1936: 147, text figs. 5–6, pl. 34, fig. 3 Fig. 29*b*

LOCAL DISTRIBUTION: On coral, Sta. 2 (11145); Sta. 7 (11253).

The presence of extended assimilatory filaments over the entire thallus and the fasciculate nature of the short assimilatory filaments, in which the terminal cell is the largest in diameter, are distinctive.

Galaxaura filamentosa Chou 1945: 39, pl. 1, figs. 1–6, pl. 6, fig. 1 (Revillagigedo Archipelago, Mexico); Dawson 1953: 51, pl. 19, fig. 2 Fig. 30*a*

LOCAL DISTRIBUTION: On coral dredged from 2–3 m., Sta. 2 (11377).

Galaxaura fastigiata Decaisne 1842: 116 (syntype from Manila, Philippines); Dawson 1953: 50, pl. 20, fig. 2; Svedelius 1945: 28, text figs. 14–16, pls. 4, 5, 6, fig. 2 Fig. 30*b*

LOCAL DISTRIBUTION: On coral fragments, Sta. 1 (11120).

This material is in full agreement with Cumming syntype material from Manila, now in the Museum at Paris.

Key to the Species of *Gelidium*

1. Thalli cylindrical or subcylindrical .... **G. crinale**
   Thalli compressed to flat 2
2. Forming a turf to 4 mm. thick .... **G. pusillum**
   Not forming a turf; 1–2 cm. tall 3

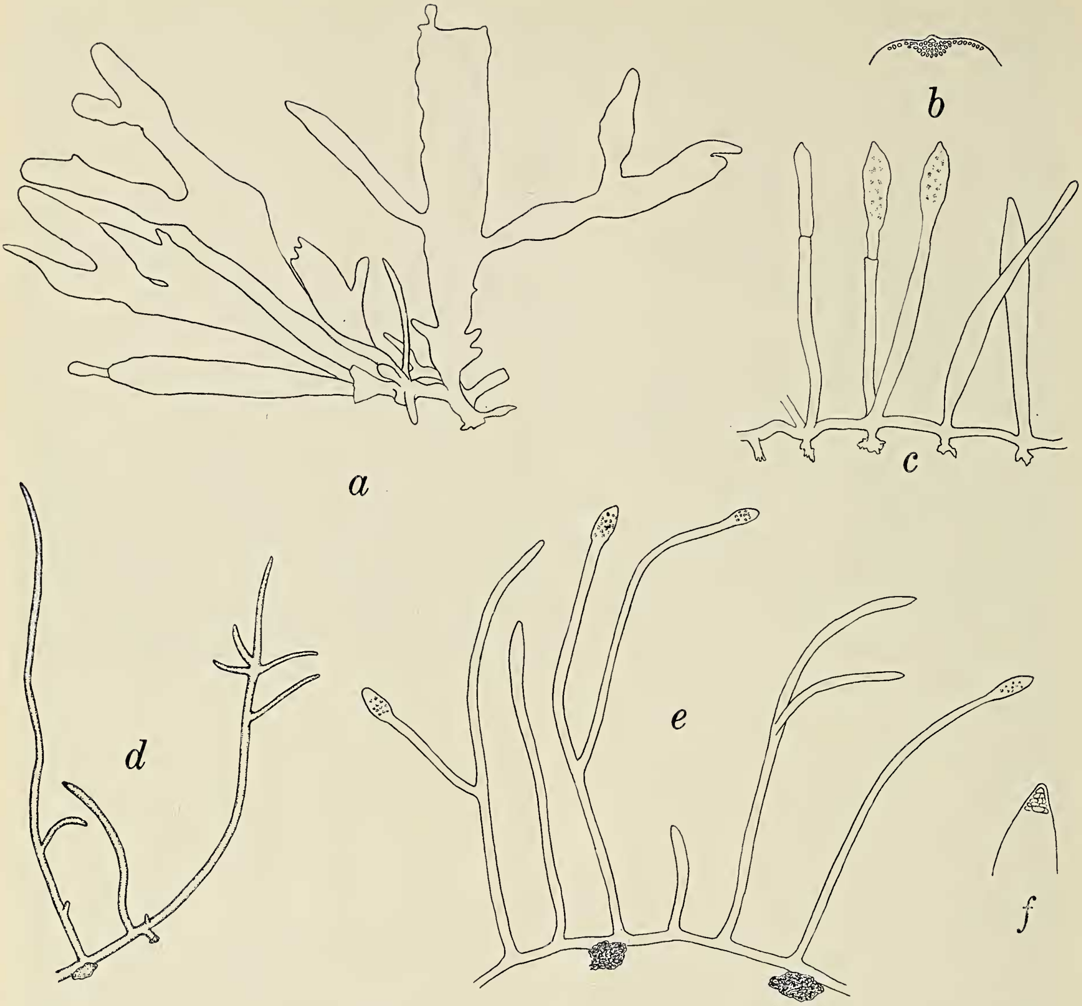

FIG. 31. *a–c*, *Gelidium pusillum: a*, Habit of a plant of 11069, × 15.5; *b*, apex of a blade showing apical cell, × 150; *c*, habit of part of a tetrasporic plant of 11307. *d*, *Gelidium crinale:* A small portion of a tuft, × 7. *e, f*, *Gelidium crinale* var. *perpusillum: e*, Habit of part of a plant, × 16; *f*, tip of a filament showing apical cell, × 100.

3. Main axes flat, much broader than ultimate branchlets . . . . **G. divaricatum,** prox.

Main axes compressed, not much broader than ultimate branchlets . . . . **G. pulchellum,** prox.

Gelidium pusillum (Stackh.) Le Jolis 1864: 139. *Fucus pusillus* Stackhouse 1801: 17, pl. 6 (England) Fig. 31*a–c*

LOCAL DISTRIBUTION: Forming a dense tuft 2–4 mm. thick on rocks at middle and upper levels, Sta. 1 (11069, 11307).

As in other parts of the world this small plant is variable. The illustrations represent two of the variants.

Gelidium crinale (Turn.) Lamouroux, in Bory 1825: 191; Dawson 1953: 64, pl. 4, fig. 3. *Fucus crinalis* Turner 1819: 4, pl. 198 (England) Fig. 31*d*

LOCAL DISTRIBUTION: Forming tufts to 1.5 cm. high on small, sedentary molluscs, Sta. 2 (11086).

Gelidium crinale var. **perpusillum** Piccone and Grunow, in Piccone 1884*b*: 317 (Red Sea); Weber van Bosse 1921: 225
Fig. 31*e*, *f*

LOCAL DISTRIBUTION: Forming a coarse velvet on mangrove roots, Sta. 12 (11396).

This tiny plant, reaching a maximum of 3.5 mm. in height, has abundant rhizoidal filaments in the medulla and seems to agree fully with the description of this minute variety of *G. crinale*.

Gelidium divaricatum Martens, prox. Martens 1866: 30, pl. 8; Okamura 1901, Illust. pl. 2; Tseng 1936*a*: 36, pl. 4, fig. 18a, b
Fig. 32*a*

LOCAL DISTRIBUTION: Growing in dense tufts to 1.5 cm. high, Sta. 6 (11451).

These plants agree in stature and in branching with this small species, but are flatter and with more attenuation of some of the branches than either Japanese or Chinese specimens. The internal structure is agreeable either with *Gelidium* or *Pterocladia*, and, in the absence of cystocarpic examples, this determination must be considered only approximate.

Gelidium pulchellum (Turn.) Kütz., prox. Feldmann and Hamel 1936: 119, fig. 23, pl. 1, figs. 2, 3
Fig. 32*b*

LOCAL DISTRIBUTION: Sta. 4 (11203).

This tetrasporic material shows similarity to some of the Mediterranean variants of *Gelidium pulchellum* in its stature, compressed axes, and pinnate branching. The tetrasporic branchlets are simple and lanceolate, unlike those of *G. crinale*, but their acute apices and lack of a sterile margin do not permit them to be assigned to *G. pulchellum* without query. Additional Indo-Pacific material must be examined to determine the range of variability and proper affinities of this small plant. It shows some resemblance to *G. pseudointricatum* Skotts. & Levring (Levring, 1941: 635).

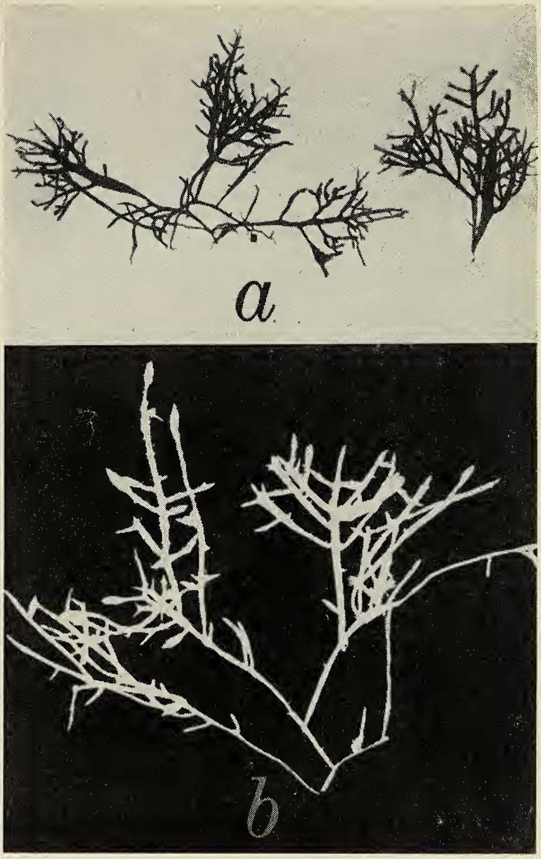

FIG. 32. *a*, *Gelidium divaricatum*, prox.: Habit, × 2.5. *b*, *Gelidium pulchellum*, prox.: Habit, × 3.6.

Pterocladia parva Dawson 1953: 77, pl. 6, fig. 2 (Gulf of California)
Fig. 33*a–c*

LOCAL DISTRIBUTION: Growing as a dense turf about 1.5 cm. thick on rocks, Sta. 6 (11223); forming a turf 4–6 mm. thick on coral fragments, Sta. 10 (11348); sparsely tufted on rocks, Sta. 10 (11326).

Although there is considerable variation in branching among these three collections, their size, habit, morphology, and structure are in good agreement with the Mexican type and paratype material.

Key to the Species of *Gelidiella*

1. Plants 2–3 cm. tall, branches arching . . . . **G. acerosa**

   Plants 1 cm. tall or less 2

2. Plants tufted, to 1 cm. tall . . . . **G. myrioclada**

   Plants minute, partially creeping, 1.5–2 mm. tall 3

3. Basal creeping branches attached at intervals . . . . **G. tenuissima**

   Basal creeping branches attached by rhizoids along their entire length . . **G. adnata**

Gelidiella acerosa (Forsk.) Feldmann and Hamel 1934: 533. *Fucus acerosus* Forskål 1775: 190 (Red Sea). *Echinocaulon acerosum* (Forsk.) Børgesen 1932: 5, pl. 1, fig. 3
Fig. 33*g*

LOCAL DISTRIBUTION: On rocks slightly exposed at low tide, Sta. 4 (11204); abundant and commonly collected for food from rocks at low-tide level, Sta. 10 (11340).

Gelidiella myrioclada (Børg.) Feldmann and Hamel 1934: 533. *Echinocaulon myriocladum* Børgesen 1934: 5, figs. 4, 5 (Bombay, India)
Fig. 33*d*

LOCAL DISTRIBUTION: Tufted, to 1 cm. tall, on rocks, Sta. 10 (11341).

My fertile plants are in complete agreement with Børgesen's account of the Indian type.

Gelidiella tenuissima Feldmann and Hamel 1936: 102 (Mediterranean France). *Gelidiella pannosa* (Bornet) Feldmann and Hamel 1934: 534, figs. 1, 2. *Gelidium pannosum* Bornet 1892: 267 (non *G. pannosum* Grunow); Weber van Bosse 1921: 223, fig. 68, pl. 7, fig. 3
Fig. 33*e*

LOCAL DISTRIBUTION: Forming a coarse velvet of filaments 1.5–2 mm. long on rather high coral rocks, Sta. 1 (11302).

These plants are in particularly good agreement with the Indonesian specimens of Weber van Bosse. In the few stichidia examined, the sporangia were not in very clear transverse rows as is usual in the species.

Gelidiella adnata sp. nov.
Fig. 33*f*

Thallis minutis, repentibus, e filamento basali, cylindrico, prostrato, 40–70 μ diametro, per totam superficiem inferiorem ope seriei densae rhizoidum brevium adjunctis, per superficiem superiorem filamenta vegetativa haud fere ramificata 35–60 μ diametro, 1.5–2.0 mm. alta, atque stichidia tetrasporangialia brevia, erecta, emittentibus; -tichidiis plerumque in pedicellis brevibus gracilibusque, 80–90 μ latis, lanceolatis, ad 400–500 μ longis crescentibus, sporangiis in stratis transversis fere quaternis dispositis.

Thalli minute, creeping on rock surfaces, consisting of a cylindrical, prostrate basal filament 40–70 μ in diameter attached along its entire undersurface by a dense rank of short rhizoids, this giving off along its dorsal surface erect, usually unbranched, vegetative filaments 35–60 μ in diameter, 1.5–2.0 mm. tall, and short, erect, tetrasporangial stichidia; stichidia mostly on short, slender pedicels, 80–90 μ broad, lanceolate, becoming 400–500 μ long, the sporangia usually arranged in groups of four in regular transverse tiers; tetrasporangia about 25 μ in diameter, tetrahedrally divided; cortical cells in surface view longitudinally elongated and tending to be arranged in rows.

TYPE: Holotype is Dawson 11309, Feb. 13, 1953, in the U. S. National Herbarium.

Type Locality: Growing on intertidal rock surfaces with *Herposiphonia* along rocky shore, Sta. 9.

This minute *Gelidiella* differs from similarly small *G. tenuissima* by its adnate basal branch and by the pedicellate stichidia arising from it among the simple, erect, vegetative branches.

Since the above was written, young, sterile specimens, seemingly of this species, have been found at Isla San Benedicto, Revillagigedo Archipelago, Nov. 17, 1953.

Gelidiopsis intricata (Ag.) Vickers 1905: 61; Yamada and Tanaka 1938: 74, fig. 6a–c. *Acrocarpus intricatus* Kützing, Tab. Phyc.

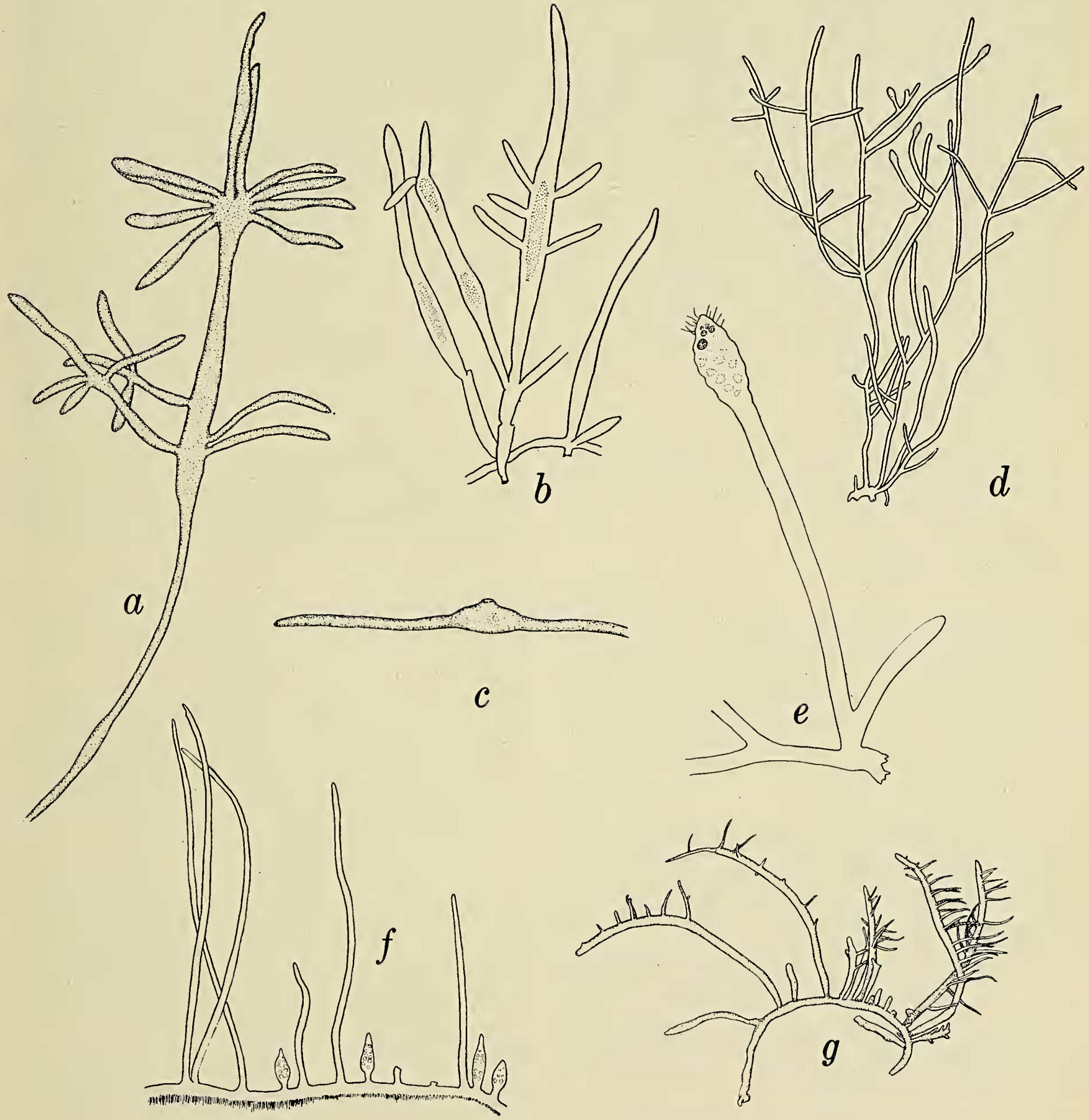

FIG. 33. *a–c, Pterocladia parva: a,* A single erect axis of 11223 with its characteristic groups of pinnate branchlets, × 10; *b,* part of a tetrasporic plant of 11348 showing the elongated sori, × 12; *c,* a cystocarp of 11348 in lateral view, × 20. *d, Gelidiella myrioclada:* Habit of part of a tuft bearing tetrasporangial stichidia, × 8. *e, Gelidiella tenuissima:* Part of a plant bearing a tetrasporangial stichidium, × 50. *f, Gelidiella adnata:* Habit of part of a tetrasporangial plant of the type collection showing several young stichidia, × 28. *g, Gelidiella acerosa:* Habit of part of a plant, × 1.5.

18, pl. 35d–f. *Acrocarpus capitatus* Kützing, Tab. Phyc. 18, pl. 35a–c. *Sphaerococcus intricatus* C. Agardh 1822: 333 (Ravak Island)
Fig. 34*a–d*

LOCAL DISTRIBUTION: Forming small, sparse tufts and clumps 1–2 cm. high on coral fragments, Sta. 7 (11243); to 3.5 cm. high on rocks, Sta. 11 (11409); Xa Cu Bay, Île de Tre, Aug. 23, 1949 (coll. R. Serene).

These specimens are variable in diameter and in the degree of branching, compression, and attenuation of some of the erect branches, but in general agree well with the illustrations of Kützing and of Yamada and Tanaka. The swollen, terminal tetrasporic stichidia are distinctive. The branches range mostly between 175 and 250 μ, some becoming attenuated to about 100 μ. Antheridia seem not to have been illustrated before.

A fragment of Kützing's type material of *Acrocarpus capitatus* from New Caledonia has been sectioned and found to agree well with the Viet Nam collections. I venture to place that name in synonymy.

Wurdemannia miniata (Lmk. & DC) Feldmann and Hamel 1934: 544, figs. 9–11; Dawson 1953: 86. *Fucus miniatus* Lamarck and DeCandolle 1815: 6 (Mediterranean France)
Fig. 35

LOCAL DISTRIBUTION: Forming dense, wiry mats on coral fragments, Sta. 13 (11437); tufted, to 2 cm. high, Sta. 4 (11185); on coral fragments, Sta. 7 (11242).

The branches range in diameter from 140 to 230 μ, although some small forms may be somewhat less than 100 μ in diameter. No apical cell is present.

Hildenbrandia prototypus Nardo 1834: 675 (Adriatic Sea); Dawson 1953: 95, pl. 7, fig. 4
Fig. 36*a, b*

LOCAL DISTRIBUTION: Forming thin, deep-red films on upper intertidal rocks and stones in tide pools, Sta. 1 (11073); Sta. 11 (11410).

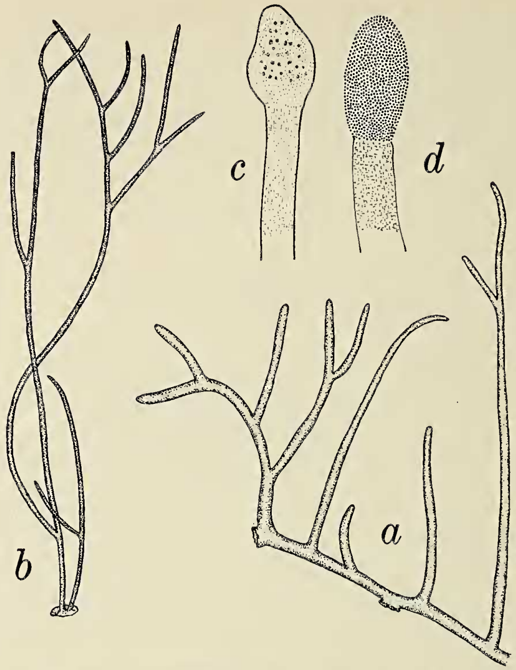

FIG. 34. *a–d*, *Gelidiopsis intricata*: *a*, Habit of part of a plant of 11243, × 4.5; *b*, part of a tuft of 11409, × 2; *c*, a tetrasporangial stichidium of the same, × 20; *d*, a capitate antheridial branch-apex of 11243, × 17.

Peyssonelia rubra var. **orientalis** Weber van Bosse 1921: 270, figs. 86–89 (Indonesia); Dawson 1953: 104, pl. 10, figs. 8, 9; Taylor 1950: 121
Fig. 36*c*

LOCAL DISTRIBUTION: Forming a firmly adherent, thin (60–70 μ thick) reddish crust on coral fragments, Sta. 1 (11070); bright reddish crusts 150–200 μ thick on a shell dredged from 5 m. off Cau Da (11123).

The material examined is sterile but agrees vegetatively with the accounts of this species from Indonesia and from Mexico.

Peyssonelia gunniana J. Agardh 1876: 387 (Eastern Australia); Weber van Bosse 1921: 272, fig. 90
Fig. 36*d*

LOCAL DISTRIBUTION: Forming loosely adherent, partially free crusts on coral, Sta. 7 (11238).

This species is distinguished by its loosely attached habit, its multicellular rhizoids, and ascending perithallium cell rows. It is quite brittle when dry, and dull in color. It is more heavily calcified than Australian examples I have seen.

Peyssonelia calcea Heydrich 1897: 10 (Tami Island, New Guinea); Weber van Bosse 1921: 277, fig. 94; Dawson 1953: 107
Fig. 37*a*

LOCAL DISTRIBUTION: Crustose, on coral fragments, Sta. 1 (11071).

These specimens are in good agreement with the species as known both from the Indonesian region and from Socorro Island, Mexico. They are heavily calcified, 500 μ thick, yellow brown in color, with intercellular spaces between the decalcified perithallium cells, numerous unicellular rhizoids, and conspicuous heterocysts among the small superficial cells.

FIG. 35. *Wurdemannia miniata:* Habit of part of a plant extracted from a tuft with small bits of *Hypnea* attached at points A and B, × 5.

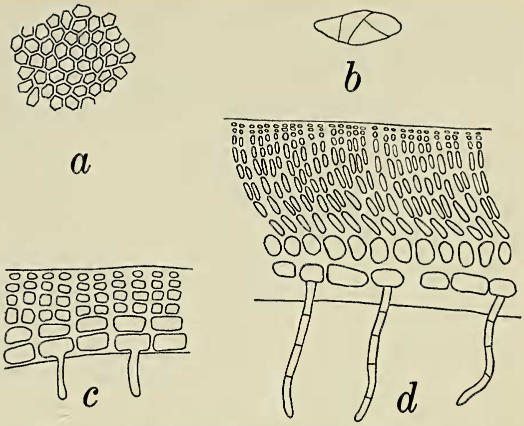

FIG. 36. *a*, *b*, *Hildenbrandia prototypus:* *a*, Minute, angular vegetative cells of the thallus as seen in surface view, × 350; *b*, a tetrasporangium 30 μ long showing the irregular divisions, × 350. *c*, *Peyssonelia rubra* var. *orientalis:* A small portion of a sterile thallus in vertical section showing the unicellular rhizoids and erect perithallus cell rows, × 180. *d*, *Peyssonelia gunniana:* A small portion of a sterile thallus in vertical section, × 200.

Fosliella farinosa (Lamx.) Howe 1920: 587. *Melobesia farinosa* Lamouroux 1816: 315, pl. 12, fig. 3 (Europe); Lemoine, in Børgesen 1917: 170, fig. 165
Fig. 37*c*

LOCAL DISTRIBUTION: On *Sargassum*, Sta. 3 (11169).

These plants have tetrasporic conceptacles 150–200 μ in diameter and seem better referred here than to *Fosliella paschalis* (Lemoine) Setch. & Gard. The heterocysts are conspicuous.

Hydrolithon reinboldii (W. v B. & Fosl.) Foslie 1909: 55. *Lithophyllum reinboldii* Weber van Bosse and Foslie, in Foslie 1901: 5 (Indonesia); Weber van Bosse and Foslie 1904: 49, fig. 21, pl. 10, figs. 1–6
Fig. 37*b*

LOCAL DISTRIBUTION: On stones, Sta. 3 (11211).

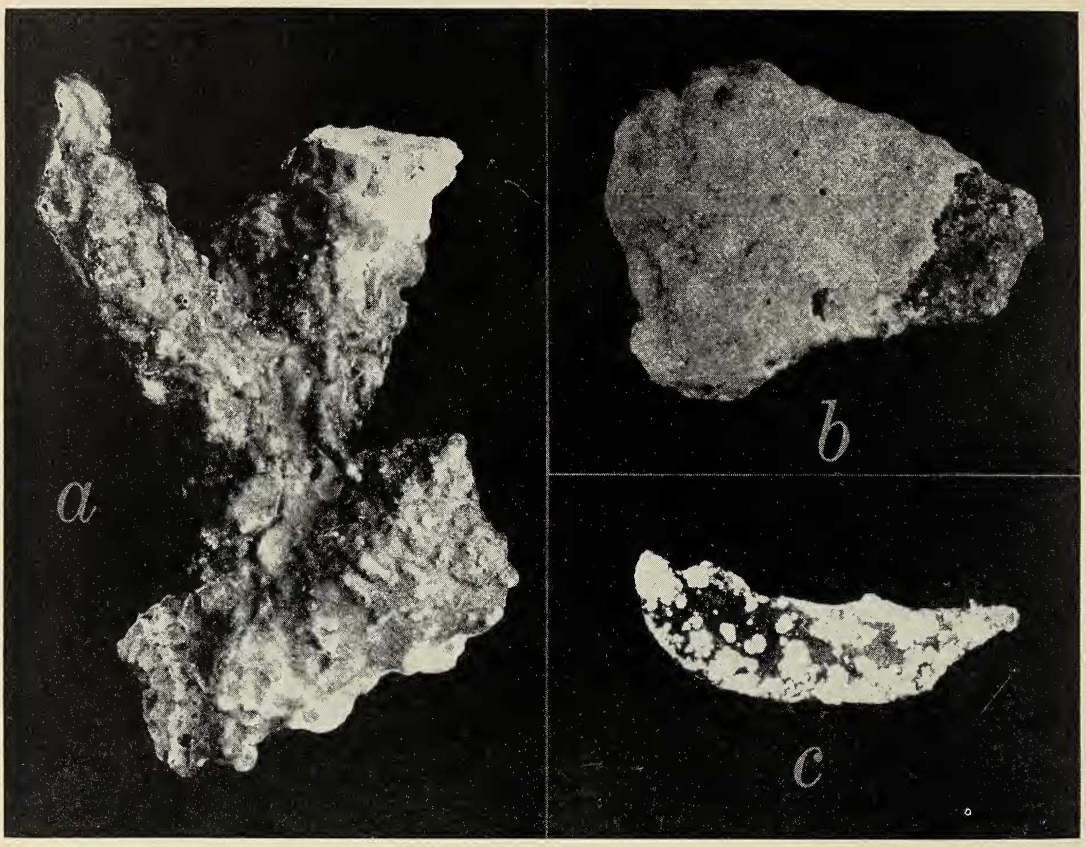

FIG. 37. *a*, *Peyssonelia calcea:* Habit of a specimen on a coral fragment, × 1.2. *b*, *Hydrolithon reinboldii:* Habit of a plant on a stone, × 1.5. *c*, *Fosliella farinosa:* Habit of plants on a "leaf" of *Sargassum*, × 1.4.

This genus is characterized by its monostromatic hypothallium of cells 18–25 μ long, its irregularly shaped and arranged perithallium cells, and scattered heterocysts. The specimen figured is a young one in which the low, rounded excrescences of older forms have not yet fully developed. The tetrasporangial conceptacles are about 350 μ in diameter as seen from above, low and convex.

Lithothamnium erubescens var. **subflabellatum** Foslie, in Weber van Bosse and Foslie 1904: 31, pl. 3, figs. 23–25 (Indonesia) Fig. 38*a–c*

LOCAL DISTRIBUTION: On coral dredged from 2–3 m., Sta. 2 (11381); at low-water level in dark tideways, Sta. 9 (11322); on coral fragments, Sta. 13 (11439).

This material seems clearly to agree with the type specimens of var. *subflabellatum* as illustrated and described by Foslie. He maintains that the species is variable and widespread in both the Atlantic and Pacific. The compressed branches and more or less flabellate branch systems are distinctive.

Lithophyllum trichotomum (Heydr.) Lemoine 1929: 45; Dawson 1944: 267, pl. 55, fig. 2, pl. 58, figs. 1, 4–6, pl. 60. *Lithothamnion trichotomum* Heydrich 1901: 538 (Gulf of California) Fig. 38*d*

LOCAL DISTRIBUTION: On old coral fragments, Sta. 7 (11239).

Both superficial and embedded tetrasporangial conceptacles have been examined in this plant. They are 350–400 μ in diameter and low convex when superficial. The form and structure of this plant compare well with some of the writer's Mexican collections. The slender, irregularly forked, erect branches arise from a rather thin crust whose margins are sometimes slightly free and undulate.

Lithophyllum okamurai Foslie 1900: 4 (Sagami, Japan); Foslie, in Weber van Bosse and Foslie 1904: 59, pl. 11, figs. 11–19 Fig. 39*a*

LOCAL DISTRIBUTION: In shallow water, Sta. 7 (11240).

The single specimen at hand appears to correspond with the Indonesian and Japanese plants figured by Foslie under this name. It shows a few low, domoid carposporic conceptacles about 170 μ in diameter, but sporangia were not seen. As Foslie has indicated in 1904 this species is not clearly distinguishable from plants under several other names such as *L. racemus*, *L. kaiserii*, *L. pallescens*, *L. fasciculatum*, *L. affine*, and *L. andrussowii*. Much careful study will be required before satisfactory specific limits can be assigned among the species of this complex.

Lithophyllum samoense Foslie 1906: 20 (Samoa); Foslie 1929: 38, pl. 53, fig. 19 Fig. 40*a*

LOCAL DISTRIBUTION: Growing as a thin crust on an old coral fragment, Sta. 10 (11338).

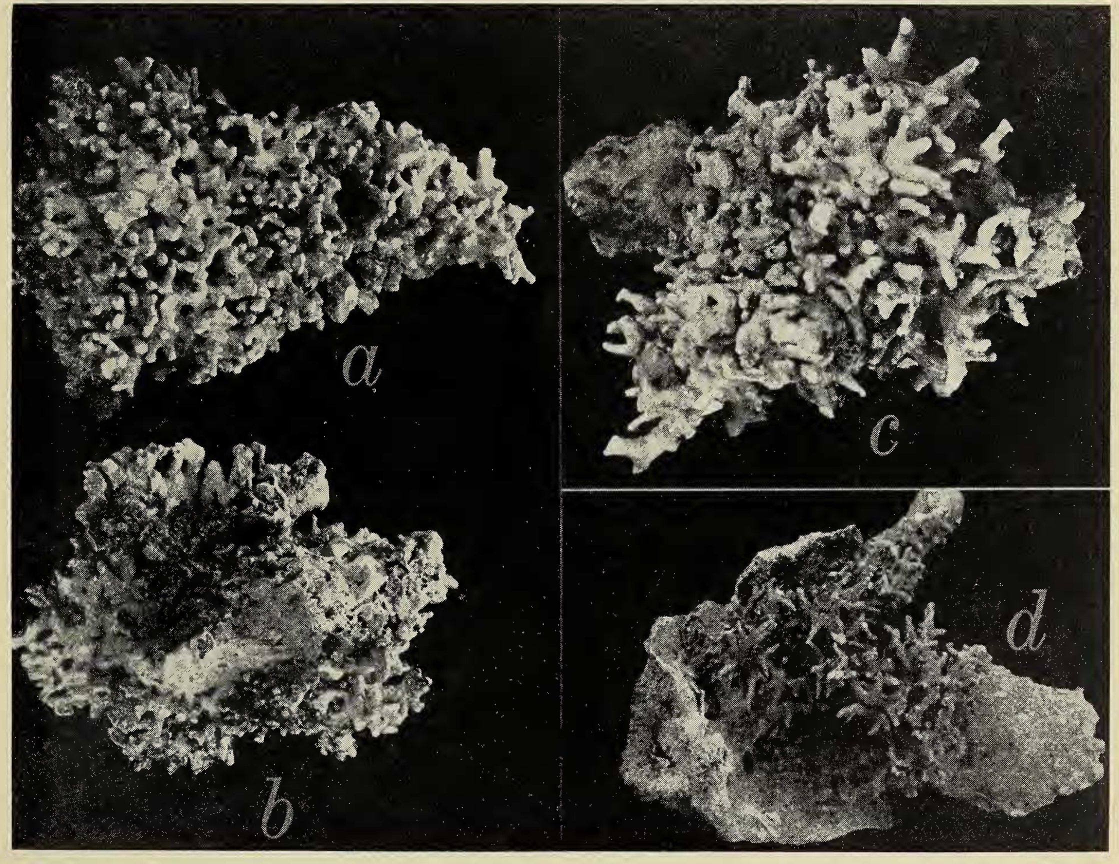

FIG. 38. *a–c*, *Lithothamnium erubescens* var. *subflabellata*: *a*, *b*, Two specimens of 11439, *a* seen from above, *b*, from below, × 1; *c*, a more openly branched example of 11381, × 1. *d*, *Lithophyllum trichotomum*: Habit, × 1.

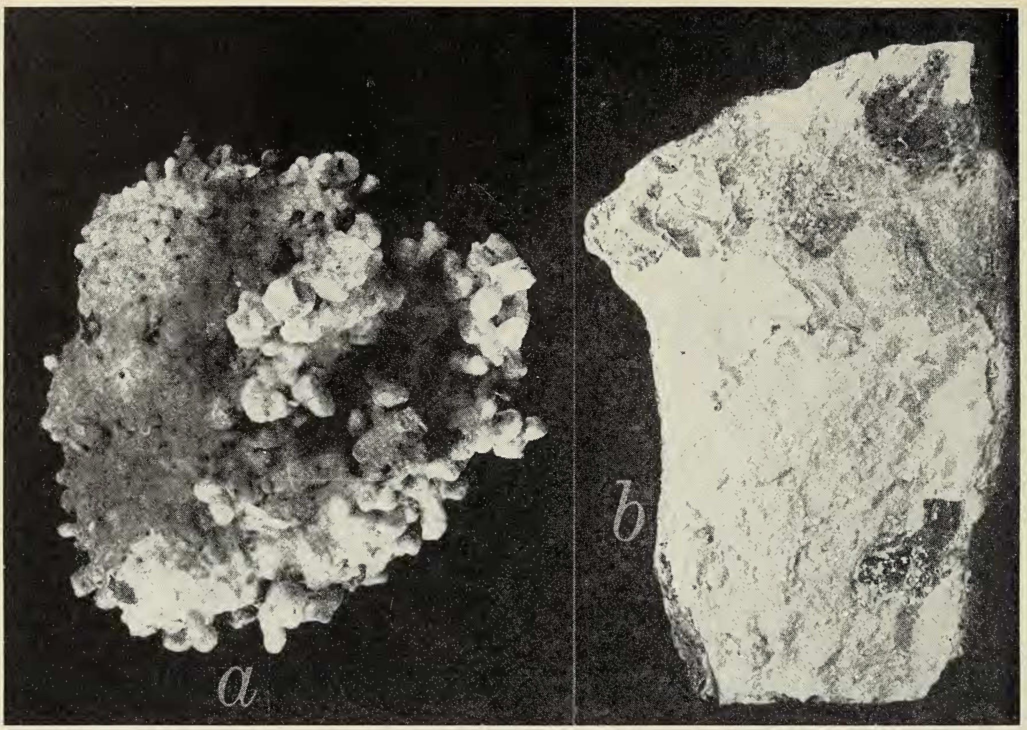

FIG. 39. *a*, *Lithophyllum okamurai:* Habit, × 0.9. *b*, *Neogoniolithon myriocarpum:* Habit, × 1.

This specimen has the characteristic structure of a thin, smooth *Lithophyllum* species and agrees well with the description of *L. samoense*. The crusts are mostly 150–200 μ thick and the small, convex tetrasporangial conceptacles only about 100–130 μ in diameter.

Neogoniolithon myriocarpum (Foslie) Setchell and Mason 1943: 90. *Lithothamnion myriocarpum* Foslie 1897: 19 (Red Sea). *Goniolithon myriocarpum* Foslie, in Weber van Bosse and Foslie 1904: 45, pl. 9, figs. 6, 7

Fig. 39*b*

LOCAL DISTRIBUTION: Growing on a shell dredged in about 5 m., Sta. 2 (11125).

This specimen agrees well in habit and structure with the descriptions and figures of this species. It forms thin crusts about 200–2,500 μ thick, becoming superimposed, and with concentric striations and large, hemispheric-conical tetrasporangial conceptacles 500–600 μ in diameter. The thallus is composed of a hypothallium of horizontal, ascending rows of elongated cells giving rise to erect, perithallium cell rows supporting an epithallium of small, flattish cells. As Foslie indicates (1904) heterocysts are scarce or unrecognizable.

Lithoporella pacifica (Heydr.) Foslie 1909: 59. *Melobesia pacifica* Heydrich 1901: 529 (Hawaii)

Fig. 40*b*

LOCAL DISTRIBUTION: Loosely attached to undersurfaces of coral dredged from 2–7 m., Sta. 2 (11281, 11376).

This species is exceedingly fragile, being monostromatic, 45–60 μ thick, and brittle from heavy calcification. Its repent habit and large conceptacles 1 mm. or more in diameter are distinctive.

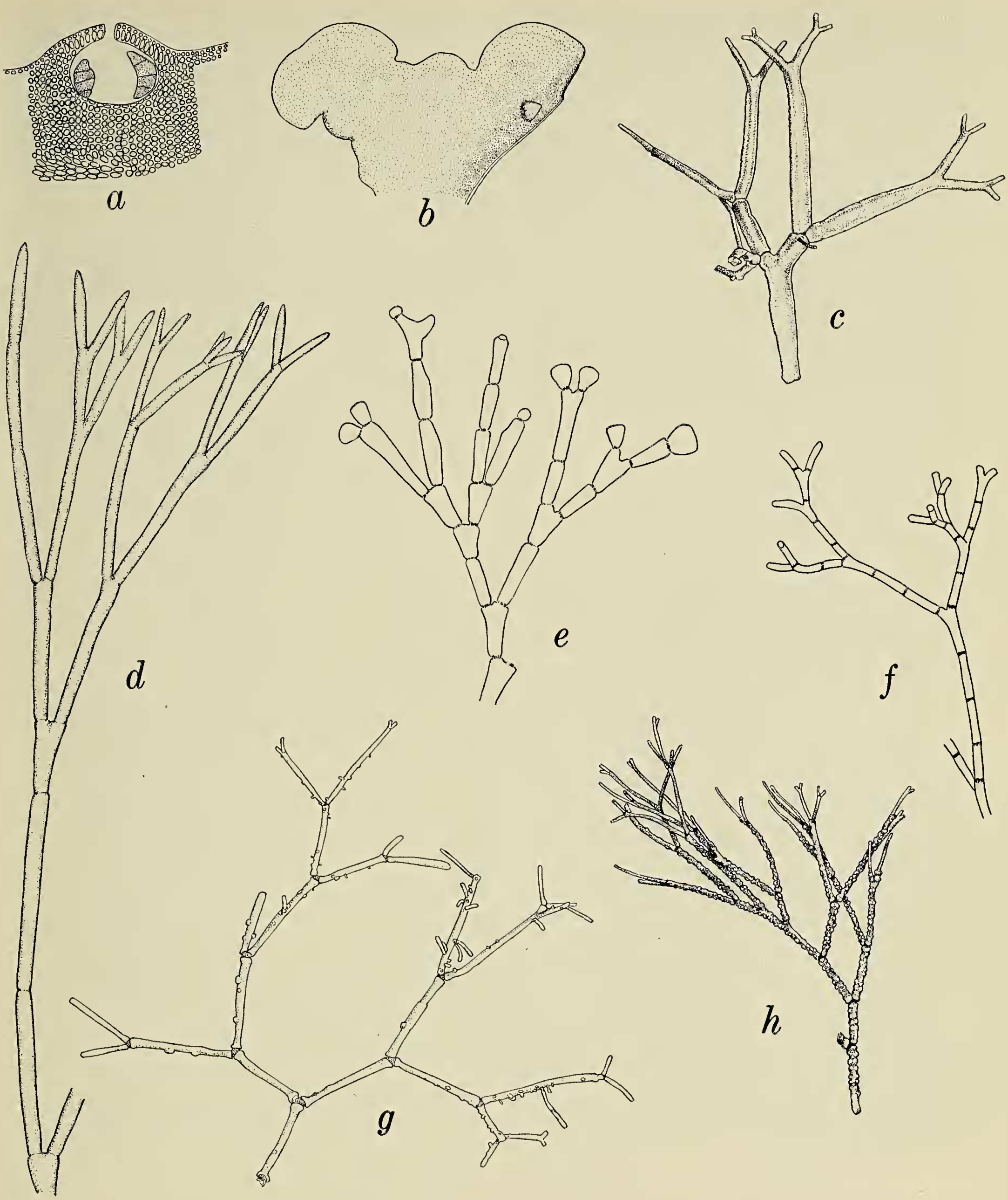

FIG. 40. *a*, *Lithophyllum samoense:* A small portion of a crust in vertical section showing a tetrasporic conceptacle, × 120. *b*, *Lithoporella pacifica:* A portion of a plant seen from the superior surface showing a conceptacle, the zonation of heavier and lighter calcification, and the relative thickness of the broken edge, × 4. *c*, *Amphiroa foliacea:* A branched upper portion of a clump, × 2. *d*, *Jania longiarthra:* An upper portion of a typical plant, × 14. *e*, *Jania ungulata* f. *brevior:* An upper portion of a plant to show branching and ungulate tips, × 16. *f*, *Jania decussato-dichotoma:* A small part of a plant, × 9. *g*, *h*, *Amphiroa fragilissima:* *g*, A portion of a loosely branched plant, × 3; *h*, a portion of a coarser plant with abundant conceptacles and less conspicuous swelling at the nodes, × 1.5.

Amphiroa foliacea Lamouroux 1824: 628, pl. 93, figs. 2, 3 (Mariannas Islands); Weber van Bosse and Foslie 1904: 92, pl. 14, figs. 1–11 Fig. 40*c*

LOCAL DISTRIBUTION: In loose clumps among other algae on coral rocks, Sta. 1 (11133).

Amphiroa fragilissima (L.) Lamouroux 1816: 298; Weber van Bosse and Foslie 1904: 89, pl. 16, figs. 1, 2, 5; Børgesen 1934: 7. *Corallina fragilissima* Linnaeus 1767: 1305 (Caribbean Sea) Fig. 40*g*, *h*

LOCAL DISTRIBUTION: In drift, Sta. 11 (11356); in drift, Sta. 3 (11098); Sta. 4 (11188).

These specimens are variable in diameter, in nodal swelling, and in the angle of branching, but seem to fall within the limits of variability of this widespread species.

Key to the Species of *Jania*

1. Terminal segments broad, ungulate, at least in part......**J. ungulata f. brevior**

   Terminal segments not broad.........2
2. Segments mostly under 125 μ in diameter ....**J. capillacea**

   Segments over 130 μ in diameter.......3
3. Angle of branching wide; segments 2.5–6 diameters long . **J. decussato-dichotoma**

   Angle of branching narrow; segments 6–12 diameters long.......**J. longiarthra**

Jania ungulata f. brevior (Yendo) 1905: 38. *Corallina ungulata* f. *brevior* Yendo 1902: 27, pl. 3, fig. 9, pl. 7, fig. 9 (Boshyu Prov., Japan) Fig. 40*e*

LOCAL DISTRIBUTION: Forming small clumps 5–8 mm. high on a sponge from Sta. 9 (11317).

The segments are 130–220 μ in diameter.

Jania decussato-dichotoma (Yendo) Yendo 1905: 37; Dawson 1953: 117, pl. 27, fig. 3. *Corallina decussato-dichotoma* Yendo 1902: 25, pl. 3, figs. 1–3, pl. 7, figs. 3, 4 (Japan) Fig. 40*f*

LOCAL DISTRIBUTION: Forming dense little clumps about 1 cm. high among other algae, Sta. 4 (11182).

These decussately branched plants have segments 130–180 μ in diameter and 2.5–6 diameters long. They are in good agreement both with Yendo's illustrations and with specimens from Pacific Mexico.

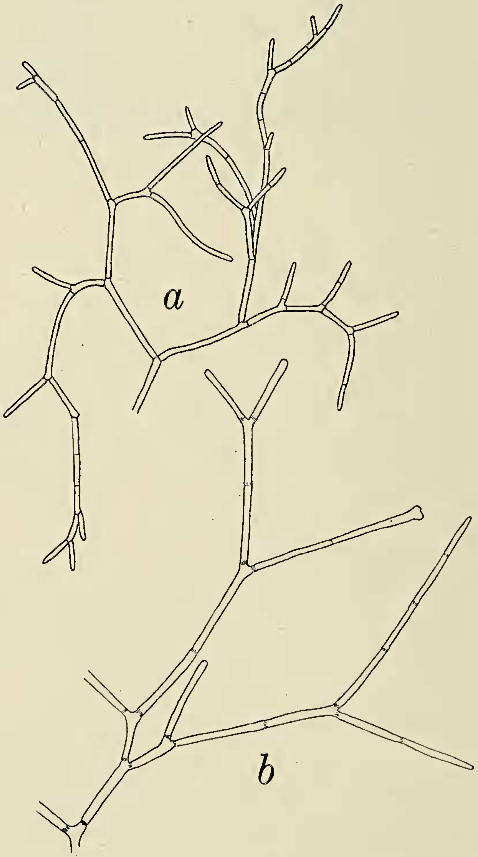

FIG. 41. *a*, *b*, *Jania capillacea: a*, A small portion of a plant of 11100 with relatively slender branches, × 10; *b*, a small portion of a relatively coarse plant of 11250 with segments 125 μ in diameter, × 10.

FIG. 42. *a*, *Grateloupia filicina:* Habit, × 1.35. *b*, *Grateloupia ramosissima:* Habit, × 1.

Jania longiarthra Dawson 1953: 119, pl. 9, fig. 4, pl. 27, fig. 4 (Espiritu Santo Island, Gulf of California)

Fig. 40*d*

LOCAL DISTRIBUTION: In drift, Sta. 3 (11099); dredged in 2–4 m., Sta. 2 (11298).

This material is identical in form and habit with the type of this Mexican species. The branches are mostly about 150–160 μ in diameter in mid-parts, thus, a little more slender than the type. The long segments, narrow angle of branching, relatively large diameter, and subulate tips distinguish it.

FIG. 43. *Halymenia dilatata:* Habit, × 0.75.

Jania capillacea Harvey 1853: 84 (Florida); Dawson 1953: 116
Fig. 41*a*, *b*

LOCAL DISTRIBUTION: Entangled with small, filamentous algae in drift, Sta. 3 (11100); on coral dredged from 2 m., Sta. 7 (11250).

The specimens in these collections are variable in diameter. Those of 11250, particularly, range in branch size from as little as 50 μ to over 125 μ in diameter.

Grateloupia filicina (Wulfen) C. Agardh 1822: 223. *Fucus filicinus* Wulfen, in Jacquin 1786–96: 157, pl. 15, fig. 2 (Adriatic Sea)
Fig. 42*a*

LOCAL DISTRIBUTION: On rocks, Sta. 6 (11235).

These plants are fertile and entirely characteristic of slender forms of this species.

Grateloupia ramosissima Okamura 1913, Icones 3: 60, pl. 117, figs. 1–11 (Southern Honshu, Japan); Tseng 1936*a*: 43
Fig. 42*b*

LOCAL DISTRIBUTION: Forming dense masses 10–15 cm. long on the face of the sea wall, Sta. 6 (11236, 11454).

My material is somewhat more slender than Japanese and Formosan specimens I have seen, but is clearly like this species in habit and branching. The abundant, short, fertile branch-

FIG. 44. *Halymenia maculata:* Habit of a small plant, × 0.66.

FIG. 45. *Titanophora pulchra:* Habit, × 1.

lets, constricted at their bases, are characteristic. The texture is much firmer than that of *G. filicina.*

Halymenia dilatata Zanardini 1851: 35 (Massaua, Red Sea); Okamura 1921, Icones 4: 109, pls. 176, 177, figs. 3, 4
Fig. 43

LOCAL DISTRIBUTION: On rocks and coral in 2–4 m., Sta. 2 (11440).

Although I have been unable to compare with the type or other material from the Indian Ocean region, my specimens agree quite fully with this species as interpreted by Okamura. His specimens came from sublittoral habitats in the Ryukyu Islands and southern Japan.

Halymenia maculata J. Agardh 1885: 12 (Mauritius); Børgesen 1950: 9, figs. 2, 3
Fig. 44

LOCAL DISTRIBUTION: Frequent on coral in 2–3 m., Sta. 2 (11441).

Børgesen's figures show close morphological and anatomical agreement with my specimens, even as to the peculiar, much-elongated, papilla-like outer cortical cells. The occurrence of this species in Viet Nam is notable inasmuch as it has been presumed to be endemic in Mauritius.

Titanophora pulchra sp. nov.
Figs. 45, 46*a*, *b*

Thallo 6–9 cm. alto, lubrico, leviter calcificato, complanato, subflabellato, undulato, ope disci parvi adnexo; ramificatione fere haud regulariter palmato flabellatoque, divisionibus ultimis brevidactyloidiis, minus quam 1 mm. latis, at parte laminarum inferiori haud regulariter divisa 1.5–2 cm. lata; superficie multa excrescentia humilia, subacuta habente; crassitudine de 2 mm. infra ad 250 μ supra; cortice e filamentis brevibus, dichotomis cellularum rotundarum in strato exteriori cellularum anticlinaliter elongatarum 7–10 μ longarum, 2.5–3 μ latarum terminante.

Thallus forming a ruffled clump 6–9 cm. high, pink in color, lubricous, lightly calcified throughout the inner region, complanate, subflabellate but not plane, attached by a small disc, expanding abruptly from a short stipe about 1.5–2 mm. long; branching primarily irregularly palmate-flabellate, the ultimate divisions short-dactyloid and less than 1 mm. wide, but the lower, irregularly divided portion of blades 1.5–2 cm. wide; surface of mature plants provided with numerous low, subacute excrescences, some of which become short, coarse, simple or palmately lobed branchlets; thickness variable from over 2 mm. below to 250–300 μ in upper parts; transection showing a broad, loose, filamentous medulla and a thin, dense cortex of short, 3–4 times dichotomous filaments of rotund cells 7–12 μ in diameter ending in the outer cortical tier of anticlinally elongated cells 7–10 μ long, 2.5–3 μ wide; gland cells not apparent; gonimoblast characteristic of the genus; antheridia borne on carposporic plants, produced solitarily on simple or irregularly branched, anticlinal cortical cells, about 2 μ in diameter; tetrasporangia unknown.

TYPE: Holotype is Dawson 11444, Mar. 17, 1953, in the U. S. National Herbarium.

Type Locality: On coral fragments in 2–3 m., Sta. 2.

In his recent treatment of this genus, Børgesen (1949) recognizes five species, *T. pikeana* from Mauritius and Ceylon, *T. incrustans* from Florida, *T. weberi* from Indonesia, *T. mauritianum* from Mauritius, and *T. calcareum* from Ponape. In habit my plants approach *T. weberi* most closely, but show a more flabellate and ruffled form with more shortly digitate ultimate segments. Structurally they disagree with that species in the presence of the outer cortical tier of elongate free cells and in the apparent lack of yellow gland cells. The presence of antheridia on a carposporic plant is notable, and it may be pointed out here that in none of these several species have tetrasporangia been reported. Furthermore, the calcified condition and the involucral branches surrounding the gonimoblast, arising from the auxiliary cell, appear to be unique in *Titanophora* among the genera of the Nemastomaceae (Feldmann 1942*a*: 112). A study of the life cycle in this genus seems to be called for to confirm or deny its assignment to the Nemastomaceae.

Key to the Species of *Hypnea*

1. Thalli mainly erect and free, not repent or turf-like 2

   Thalli mainly repent, forming a loose or compact turf; sometimes semi-erect in *H. esperi*, but only to 3 cm. high 4

2. Branches bearing small, stellate, spinous processes .... **H. cornuta**

   Branches bearing simple or branched, but not stellate, branchlets 3

3. Ultimate lateral branchlets exceedingly abundant, dense, short, often bifurcate.. .... **H. boergesenii**

   Ultimate lateral branchlets not dense or crowded, mostly long, slender, not bifurcate .... **H. valentiae**

4. Plants small, the branches 250–500 μ in diameter .... **H. esperi**

   Plants larger, the branches 700–2,500 μ in diameter 5

5. Plants loosely matted; tetrasporangial sori encircling small branchlets .... **H. cervicornis**

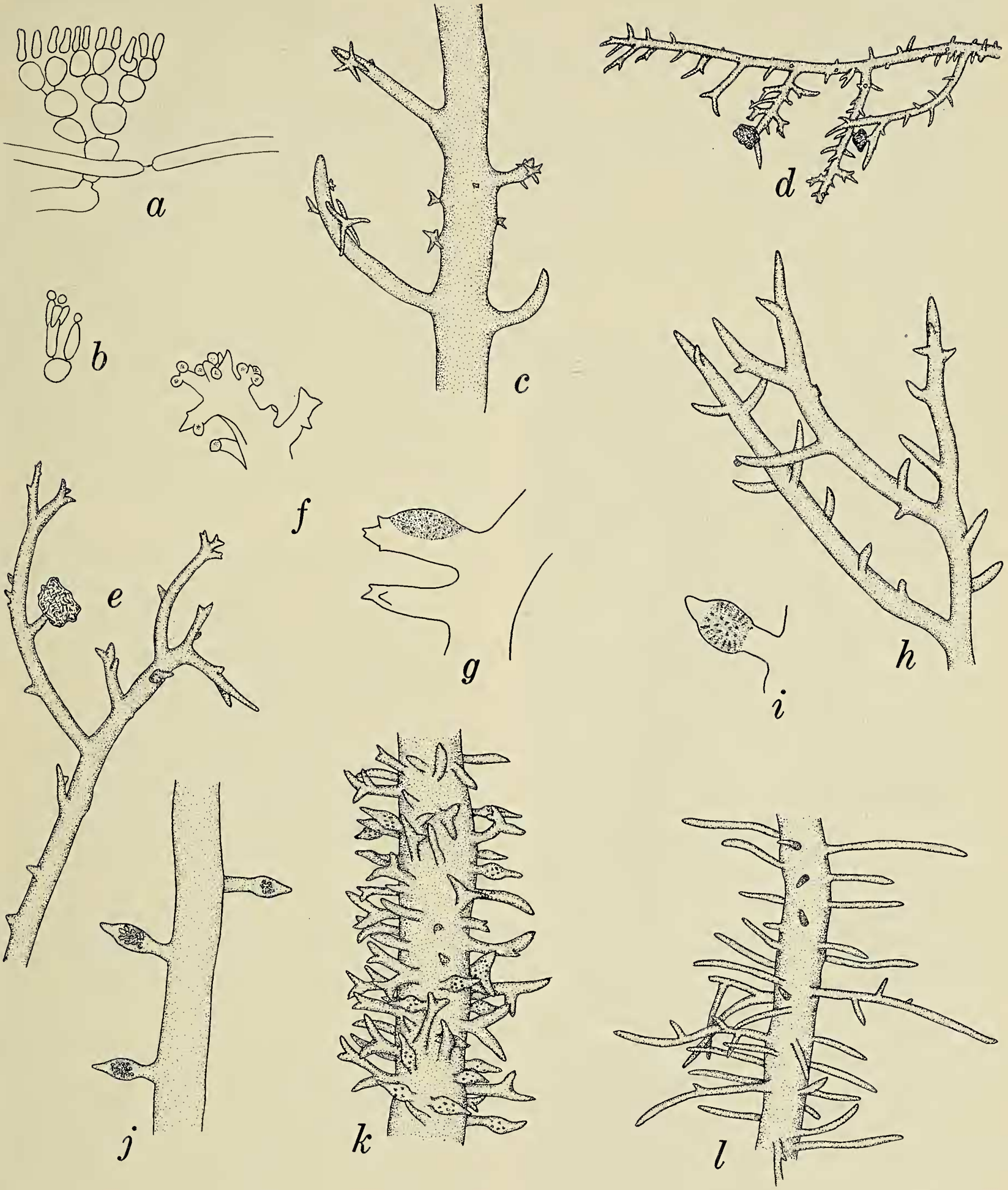

FIG. 46. *a*, *b*, *Titanophora pulchra: a*, Transectional diagram of a part of a sterile cortex, × 400; *b*, antheridial filaments from the cortex, × 700. *c*, *Hypnea cornuta:* Part of an axis bearing several stellate processes, × 8. *d*, *Hypnea cervicornis:* Habit of a small part of a matted plant showing shell fragments attached by small discs, × 3. *e–g*, *Hypnea nidulans: e*, Part of a vegetative thallus, × 3; *f*, a tetrasporangial branchlet with its saddle-shaped nemathecium, × 10; *g*, a small, terminal portion of a cystocarpic thallus, × 7. *h–j*, *Hypnea esperi: h*, Part of an axis of 11402 bearing tetrasporangial branchlets, × 21; *i*, a small part of a plant of 11349 showing the small attachment discs, × 11.5; *j*, tetrasporangial branchlets, × 35. *k*, *Hypnea boergesenii:* A relatively young part of an axis showing the short branchlets which become denser in older parts, × 10. *l*, *Hypnea valentiae:* Part of an axis showing the slender ultimate branchlets, × 8.

Plants densely matted, coarse; tetrasporangial sori unilateral, saddle-shaped..... ....**H. nidulans**

Hypnea cornuta Lamouroux, ex J. Agardh 1852: 449 (Tropical Atlantic America); Tanaka 1941: 242, fig. 14A–E
Fig. 46*c*

LOCAL DISTRIBUTION: Sta. 4 (11189, 11428); drift, Sta. 3 (11092).

FIG. 47. *Hypnea valentiae:* Habit, × 1.35.

This is the *Chondroclonium cornutum* Lamx. listed by von Martens (1866) from the south China Sea.

Hypnea boergesenii Tanaka 1941: 233, pl. 53, fig. 1, text figs. 6–8 (Formosa)
Fig. 46*k*

LOCAL DISTRIBUTION: In drift, Sta. 10 (11336).

These specimens agree well with this species, except that the percurrent axes are not so prominent, and the tips show some divaricateness of the ultimate branchlets. The plants are about the same size as the type and show the exceedingly dense development of short lateral branchlets over the entire thallus.

Hypnea valentiae (Turn.) Montagne 1840*a*: 161; Børgesen 1934: 17. *Fucus valentiae* Turner 1809, pl. 78 (Red Sea). *Hypnea charoides* Lamouroux 1813: 44, pl. 10, figs. 1–3; Kützing, Tab. Phyc. 18, pl. 22
Figs. 46*l*, 47

LOCAL DISTRIBUTION: In drift, Sta. 3 (11092a); abundant, Sta. 4 (11429).

This species is characterized by the long, slender, lateral ramuli. My material is not fertile, but it agrees with the figures cited above. Børgesen (1937) follows Hauck (1887) in considering *H. charoides* a variant under *H. valentiae*.

Hypnea esperi Bory 1829: 157 (type locality uncertain); Børgesen 1920: 306, fig. 48; Kützing, Tab. Phyc. 18, pl. 26a–c; Dawson 1944: 292; Tanaka 1941: 243, fig. 15a–d
Fig. 46*h–j*

LOCAL DISTRIBUTION: Growing in small, loose tufts to 3 cm. high on sandy mud flats adjoining Sta. 12 (11402); forming a loose turf 1.0–1.5 cm. high, lightly attached to gravel, Sta. 10 (11349).

The small size and slender branches distinguish this species among the Nha Trang hypneas.

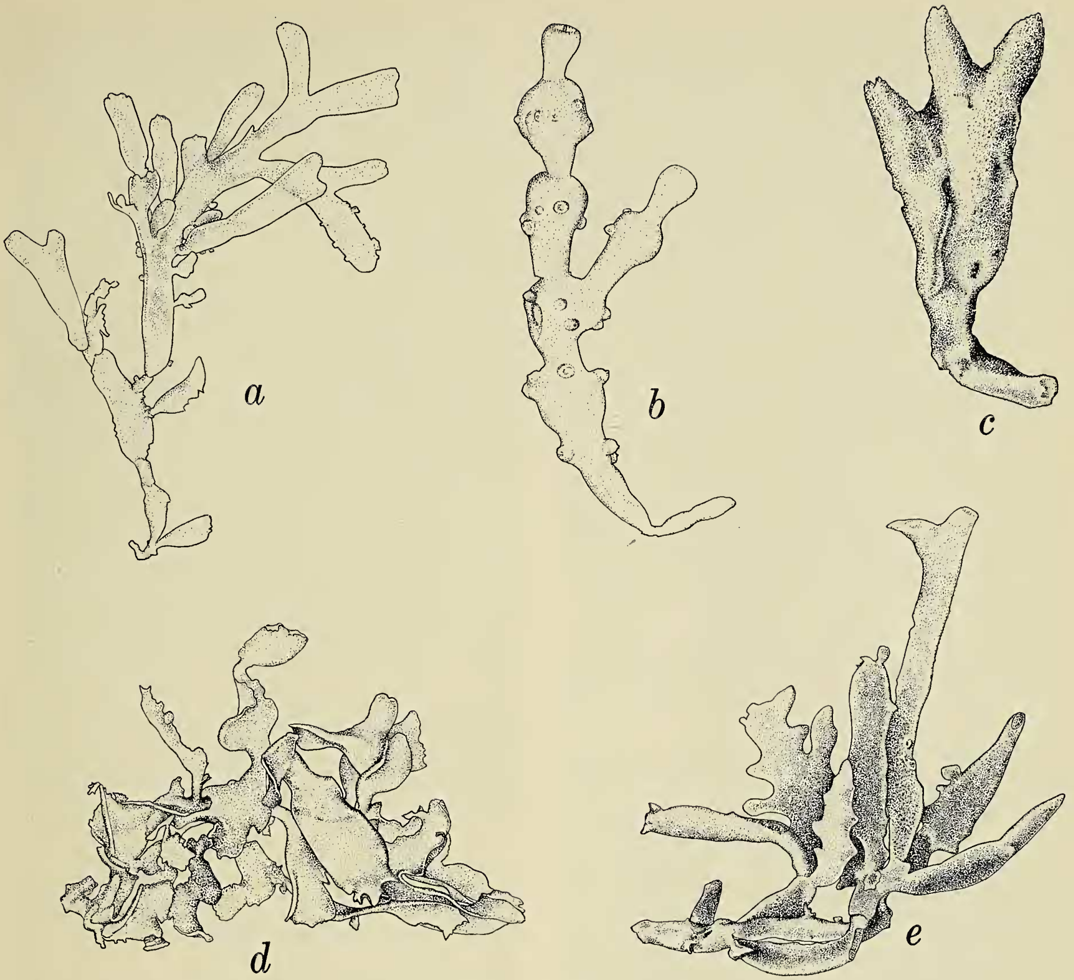

FIG. 48. *a*, *Carpopeltis formosana:* A portion of a regenerating plant, × 1.5. *b*, *Gracilaria crassa:* A mature cystocarpic branch, × 2. *c*, *Ceratodictyon spongiosum:* A small part of a ramified clump, × 1. *d*, *Gracilaria* sp.: Habit, × 2. *e*, *Gracilaria eucheumoides:* Part of a plant extracted from crevices in coral, showing several attachment discs on the fleshy segments, × 1.

Two other collections are referred here with some question: 11380 from the back of a decorator crab, and 11076 from rocks at the edge of Cau Da wharf. These are alike and tetrasporic, but are low and different in habit from the usual forms of *Hypnea esperi.* They are similar in habit to *Caulacanthus ustilatus* Kütz., but differ in structure. They seem to be like the plants Børgesen figured (1924, figs. 27, 28) as *Caulacanthus spinellus*, but later (1950) called "a small *Hypnea* species."

Hypnea cervicornis J. Agardh 1852: 451 (based on material from Brazil, West Indies, Mexico, and Mauritius); Okamura 1916, Icones 4, pl. 159, figs. 6–9, pl. 160, figs. 1–5; Tanaka 1941: 240, text fig. 13; Taylor 1942: 104; Tseng 1936*a*: 45, pl. 5, fig. 24
Fig. 46*d*

LOCAL DISTRIBUTION: Forming a loose, intricate mass, on gravel and shell fragments in intertidal pools, Sta. 9 (11115, 11316); on rocks, Sta. 6 (11448).

My specimens are smaller and more decumbent than the Japanese plants illustrated by Okamura and by Tanaka, but they agree very well with Caribbean specimens reported by Taylor. The frequent habit of growing in loosely matted fashion on coarse sand, gravel, and shell fragments in somewhat protected places has been noted by most authors. Herbarium specimens usually have many bits of such material adhering to them.

Hypnea nidulans Setchell 1924: 161 (Samoa); Tanaka 1941: 246, figs. 18–19
Fig. 46*e–g*

LOCAL DISTRIBUTION: Forming dense, pulvinate clumps on coral dredged from 2–3 m., Sta. 2 (11422, 11445); on coral rocks, Sta. 1 (11136).

These are in excellent agreement with Tanaka's illustrations of this quite clearly defined species.

Carpopeltis formosana Okamura 1931: 110, pl. 12, figs. 1–7 (Formosa)
Fig. 48*a*

LOCAL DISTRIBUTION: Cúa Bé, Aug. 28, 1949 (coll. R. Serene).

The specimens are somewhat poorly and irregularly developed due to regeneration after grazing. However, in habit, size, and structure they are in good agreement with the Formosan species.

Ceratodictyon spongiosum Zanardini 1878: 36, No. 8 (Papua); Okamura 1909, Icones 2, pls. 51, 52
Fig. 48*c*

LOCAL DISTRIBUTION: Common, forming dark-greenish to purplish, branched, anastomosing masses on rocks and coral, Sta. 1 (11112).

This red alga, living in apparent symbiotic relationship with a sponge, and assuming, with its symbiont, the form of a sponge, has been extensively illustrated by Okamura.

Gracilaria crassa Harvey, ex J. Agardh 1876: 417 (Ceylon); Børgesen 1936: 86, fig. 8; Børgesen 1952: 33. *Corallopsis opuntia* J. Agardh 1876: 409; Okamura 1933, Icones 7, pl. 308, figs. 6–11
Fig. 48*b*

LOCAL DISTRIBUTION: Sta. 2 (11081); Sta. 4 (11187).

Transections of cystocarpic thalli of this plant have been studied and found to agree with the genus *Gracilaria* in every respect. The characteristic nutritive filaments running out from the gonimoblast to the pericarp are present and conspicuous (Dawson 1949).

This fleshy, turgid plant in its younger stages grows in a contorted, creeping fashion, ramifying and attaching itself in numerous places to crevices in old coral or rocks. In this stage it is without regular constrictions. The constrictions develop as the plant matures, and these become more pronounced and the segments more elongated as the free branches become longer and more pendant. It is collected for food in the vicinity of Trúòng Dông.

Gracilaria eucheumoides Harvey 1859: 331 (Ousima, Ryukyu Islands)
Fig. 48*e*

LOCAL DISTRIBUTION: Scarce, creeping in crevices of coral in 1–2 m., Sta. 7 (11251).

Only a few sterile examples of this plant were found. It is considered an edible species in the area but does not occur abundantly enough to be specially collected.

Gracilaria verrucosa (Huds.) Papenfuss 1950: 195. *Fucus verrucosus* Hudson 1762: 470 (England). *Gracilaria confervoides* (L.) Grev., as employed by Dawson 1949: 13, pl. 15, fig. 9
Fig. 49

LOCAL DISTRIBUTION: Sta. 4 (11216, 11424); dredged from 2–4 m., Sta. 2 (11299).

The several collections cited are unmistakably of the genus *Gracilaria*, for each has cystocarpic examples showing the distinctive nutritive filaments running from gonimoblast to pericarp. In 11424, antheridial examples are present among cystocarpic individuals and exhibit the conceptacular cavities characteristic of this species. However, it was disconcerting at first to find that intermixed among specimens under 11216 were some cystocarpic plants which proved to be of the genus *Gracilariopsis* when sectioned (see below). These lack the nutritive filaments and have a gonimoblast of small cells with the sporangia in chains as shown by Dawson (1949, pl. 15, fig. 10) for *Gracilariopsis*. Superficially they could not be distinguished from specimens of *Gracilaria verrucosa*. Under 11090 other *Gracilariopsis* specimens were recognized by their cystocarps, but in that collection no *Gracilaria* specimens were found, nor was antheridial material present.

It is clear that in Cửa Bé, as in some localities in Mexico, species of *Gracilariopsis* and *Gracilaria* may intermingle in the same habitat and be quite indistinguishable macroscopically.

Gracilaria sp.

Fig. 48*d*

The present material collected by Mr. Serene at Cù Lào, May 4, 1950, is sterile and seems to be young. The most striking features of the plant are the contorted, dichotomous segments which are here and there attached to each other by accessory discs. In some respects the plant seems to approach *Gracilaria corticata* J. Ag. or *G. lingula* J. Ag., but is surely neither of these and is probably undescribed. Better developed and fertile material is needed.

Gracilariopsis rhodotricha Dawson, prox. Dawson 1949: 47, pl. 19, figs. 3–7 (Revillagigedo Archipelago, Mexico)

see Fig. 49 for habit

LOCAL DISTRIBUTION: In drift, Sta. 3 (11090); growing with *Gracilaria verrucosa*, Sta. 4 (11216a).

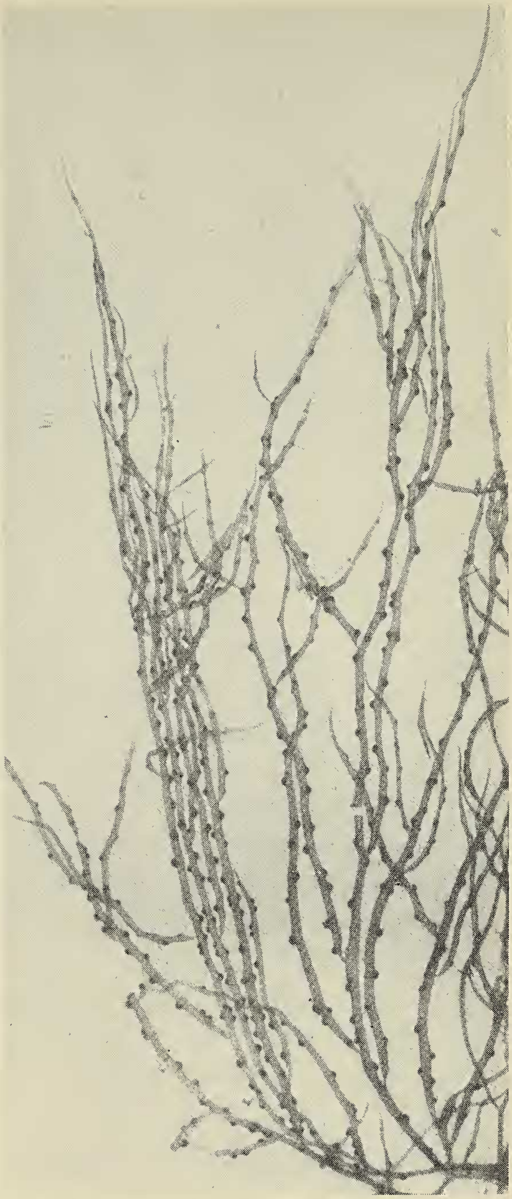

FIG. 49. *Gracilaria verrucosa:* Habit, × 1.

Inasmuch as no antheridial material was found which could positively be identified with the cystocarpic examples, this determination must remain open to question. It will be necessary to secure antheridial and cystocarpic material from colonies apart from those

FIG. 50. *Gracilariopsis* sp.: Habit, × 1.1.

of *Gracilaria verrucosa* in order to be sure that the male plants are of *Gracilariopsis* rather than of *Gracilaria*.

Gracilariopsis sp.
Fig. 50

A second species of *Gracilariopsis* is recognized by a cystocarpic example among specimens from Sta. 4 (11194, 11217). This species is of different habit from *Gracilaria verrucosa* and *Gracilariopsis rhodotricha*, but in the absence of antheridial material it cannot here be identified.

Key to the Species of *Gymnogongrus*

1. Thalli under 2 cm. tall . . . . . **G. pygmaeus**
   Thalli 4–9 cm. tall 2
2. Segments flat 3
   Segments compressed above, terete below . . . . **G. japonicus**
3. Branching divaricate, flabellate . . . . **G. flabelliformis**
   Branching rather remote, strict . **G. serenei**

Gymnogongrus flabelliformis Harvey 1856: 332 (Japan Sea); Okamura 1921, Icones 4, pl. 181, figs. 7–9, pl. 182, figs. 9–14; Tseng 1936*a:* 47
Fig. 51*a*, *b*

LOCAL DISTRIBUTION: Forming dense colonies on the sea wall, Sta. 6 (11234, 11453a).

My plants are virtually identical with some southern Japanese examples of this species in size, branching, and vegetative structure. The Nha Trang specimens lack the secondary proliferous pinnae such as are illustrated by Okamura, but this feature is not always present in Japanese plants. The only difference which may be specifically significant is in the form of the cystocarp. In Japanese plants examined, the cystocarp is embedded in the middle of the thallus and forms a bulge of about equal size on either side. In the Viêt Nam specimens the cystocarps are unilateral, the bulge being much more prominent on one side than on the other. Tseng speaks of this species as "rather variable," and in view of its wide known range from Hokkaido and Korea to Amoy, China, it seems best to assign these specimens here, despite this difference, awaiting the opportunity for comparison of additional series of plants from the southern part of the range.

Gymnogongrus pygmaeus J. Agardh 1851: 317 (India); Kützing, Tab. Phyc. 19, pl. 64; Børgesen 1936: 88
Fig. 51*c*

LOCAL DISTRIBUTION: Forming dense col-

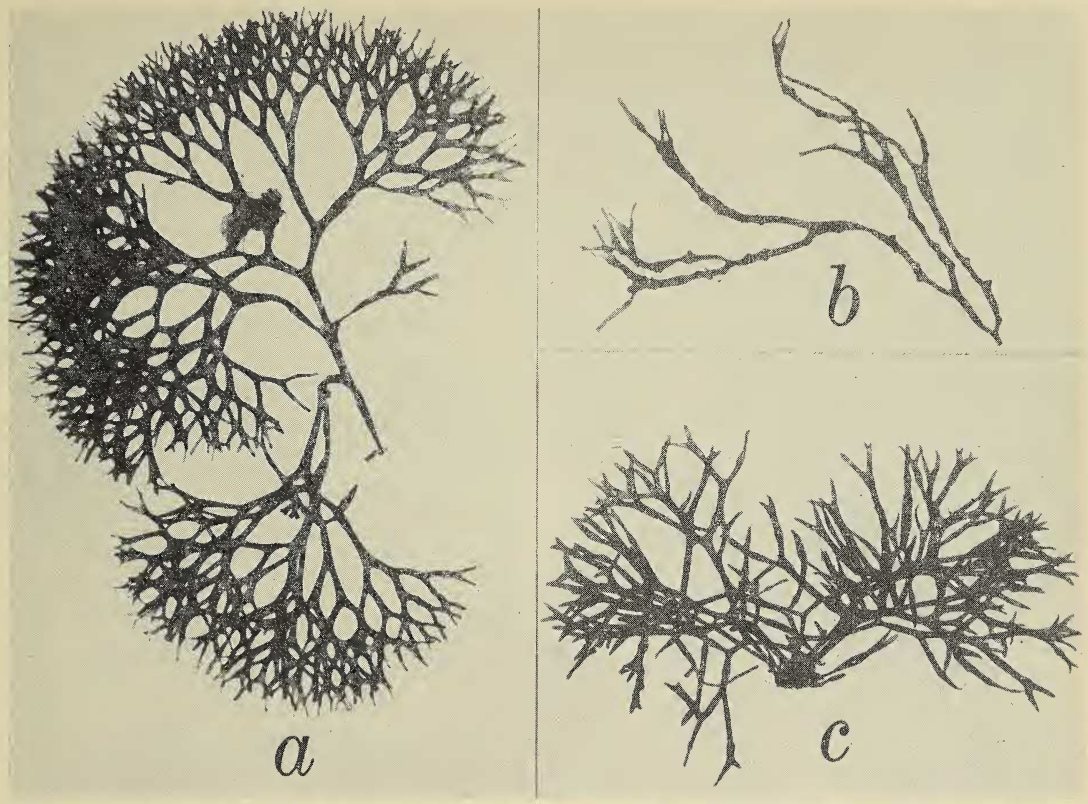

FIG. 51. *a*, *b*, *Gymnogongrus flabelliformis: a*, Habit of a vegetative plant, × 1; *b*, part of a cystocarpic plant, × 1. *c*, *Gymnogongrus pygmaeus:* Habit, × 2.4.

onies to 2 cm. high on rock surfaces, Sta. 6 (11229).

Although I have not seen any authentic material of this species, my plants agree well with Agardh's description and with Kützing's illustration of the type, except for being somewhat smaller throughout.

Gymnogongrus japonicus Suringar 1870: 36, pl. 24A 1–4 (Kyushu, Japan)

Fig. 52*a*

LOCAL DISTRIBUTION: Young cystocarpic plants forming a dense clump about 18 mm. high on the sea wall, Sta. 6 (11228, Feb. 2); older plants to 5 cm. high and more loosely branched (11453, Mar. 18).

The older plants of these collections agree well with Suringar's illustrations of habit and structure, although the medullary cells of his plants are shown to be somewhat larger than of mine. The dichotomous branching, narrow, compressed segments, blunt apices, and thickened, terete basal segments are distinctive.

Gymnogongrus serenei sp. nov.

Fig. 52*d*

Thallis ad 4 cm. altis, e pluribus laminis erectis, semirigidis, planis, subsimplicibus ad dichotomose ramificatis, ligulatis, haud stipitatis, e disco parvo; laminis 1.0–2.5 mm. latis, 300–400 μ crassis, haud frequenter ramificatis, plerumque intervallis 1 cm. plusve. anguste angulatis; marginibus integris; apicibus obtusis; antheridiis superficialibus in soris elongatis; cystocarpiis superficialibus, circiter 800 μ diametro, hemisphaericalibus.

Thalli to 4 cm. tall, consisting of several

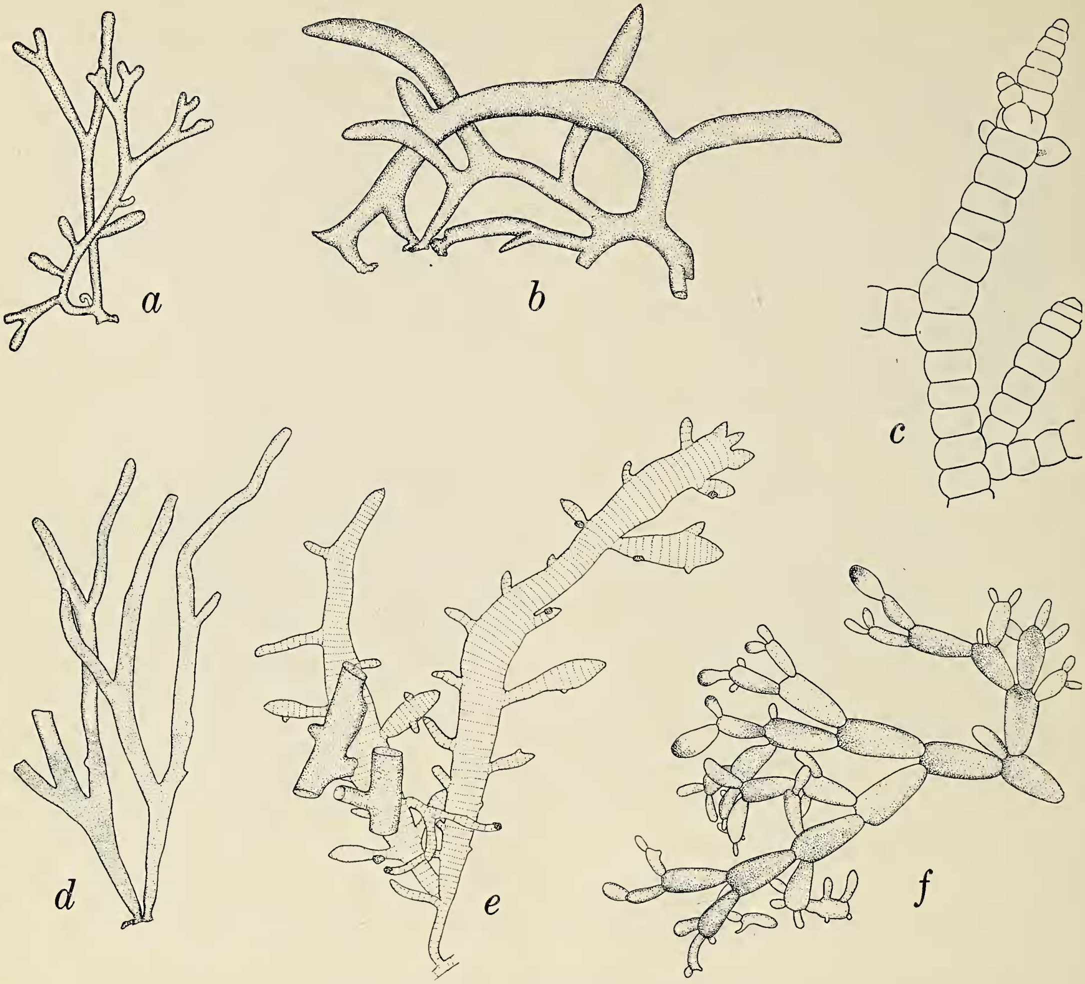

FIG. 52. *a*, *Gymnogongrus japonicus:* Habit of part of a young cystocarpic plant, × 2.5. *b*, *Gigartina intermedia:* Habit of a young plant showing formation of accessory attachment discs from tips of arching branches, × 5. *c*, *Champia parvula:* A small upper part of a plant, × 10. *d*, *Gymnogongrus serenei:* Habit of an antheridial plant of the type collection, × 1.5. *e*, *Champia vieillardii:* Habit, × 3. *f*, *Catenella nipae:* A portion of a plant dissected away from the mangrove root and seen from the upper surface, × 3.

erect, semi-rigid, flat, subsimple to dichotomously branched, ligulate, non-stipitate blades from a small, discoid attachment; blades 1.0–2.5 mm. broad, 300–400 μ thick, infrequently branched, mostly at intervals of 1 cm. or more and with narrow angles; margins entire; tips blunt; structure consisting of a medulla of rotund, thick-walled cells 30–50 μ in diameter, elliptical in longisection and with many intercellular connections, abruptly grading into a cortex of anticlinal rows of three or more small, elliptical cells about 4.5 μ in diameter; antheridia borne superficially in elongate sori on the surface of the blades; cystocarps borne on the surface of the blades, 800 μ in diameter or more, very prominent, hemispherical, sometimes causing a bulge on the opposite side of the blade; tetrasporangia not seen.

TYPE: Holotype is Dawson 11268, Feb. 6, 1953, in the U. S. National Herbarium.

Type Locality: Occasional at middle levels, Sta. 8.

This species is apparently most closely related to *Gymnogongrus tenuis* J. Ag. of the Caribbean, with which it agrees in size, flatness of frond, in transectional structure, prominent cystocarps and superficial antheridia. It seems to occupy a similar habitat on exposed, surf-beaten rocks. It differs in its remotely branched, often subsimple, ligulate blades (compare Børgesen 1919: 357, fig. 352) and its very prominent, hemispherical rather than flattened cystocarps.

Since the above was written this species has been found in the flora of Isla San Benedicto in the Revillagigedo Archipelago on the east side of the Pacific Ocean (Dawson 12058, Nov. 17, 1953).

Gigartina intermedia Suringar 1870: 30, pl. 17B (Nagasaki, Japan); Okamura 1908, Icones 1, pl. 35, figs. 1–5; Tseng 1936*a*: 49
Fig. 52*b*

LOCAL DISTRIBUTION: Forming low, pulvinate masses to 0.8–1.0 cm. high, Sta. 8 (11267).

Although my plants are sterile, they agree well in habit and structure with this species known hitherto from Japan and Amoy, China.

Catenella nipae Zanardini 1872: 143, pl. 6, fig. A1–7 (Borneo); Tseng 1942*a*: 143, fig. 2
Fig. 52*f*

LOCAL DISTRIBUTION: Creeping, closely attached and overlapping on roots of mangroves, Sta. 12 (11391).

Champia parvula (Ag.) Harvey 1853: 76.
Chondria parvula C. Agardh 1824: 207 (Cadiz, Spain)
Fig. 52*c*

LOCAL DISTRIBUTION: Small clumps about 1 cm. high, Sta. 8 (11260).

Champia vieillardii Kützing 1866, Tab. Phyc. 16, p. 14, pl. 37e, f (New Caledonia)
Figs. 52*e*, 53

FIG. 53. *Champia vieillardii:* Habit, as reproduced from Kützing's Tabulae Phycologicae.

LOCAL DISTRIBUTION: Attached to coral fragments in shallow water, Sta. 13 (11436).

Although this name was reduced by De Toni (1900: 561) under *Champia compressa* Harv., the present material strongly suggests that this action was in error. Kützing's figure 37e shows a tripinnate plant of apparently semi-prostrate habit with abundant, short, ultimate pinnules. In these characters as well as in size and aspect my plants are identical with his. *Champia compressa* differs in its more erect habit, less strongly compressed thallus, more remote and longer ultimate branches (see Harvey 1847, pl. 30). My plants also show features which were only partially indicated by Kützing, namely, the slender, subterete character of some of the longer of the ultimate branches as well as basal ones, and their service in attachment by growing down to the substrate or to other portions of the plant and forming small adherent discs.

Antithamnion sp.
Fig. 54*c*, *d*

LOCAL DISTRIBUTION: Forming a fine pinkish pile 3–4 mm. high on the surface of coral dredged from 2–3 m., Sta. 2 (11366).

This material is quite clearly of an undescribed species apparently nearly related to *Antithamnion antillanum* Børgesen (1917) which Nasr (1941) considers a variety of *A. lherminieri* (Cr.) Born. Unfortunately my material was rather badly preserved and does not remain in suitable condition for description and deposition of a type. However, it is here illustrated and briefly characterized for the aid of future collectors.

Like *A. antillanum*, this plant has creeping, verticillately branched, main filaments, part of the branches becoming transformed into rhizoids while others become erect and in turn alternately branched. The basal cells of the branches from the primary axes are usually much shorter than the others, as in *A. antillanum*, but no gland cells have been observed. The tetrasporangia and capitate antheridial clusters are pedicellate as shown in the figures. The cystocarps consist of a gonimoblast cluster surrounded by a dense involucre of incurved branchlets about 500 μ long, somewhat as in *Mesothamnion* (Børgesen 1917: 214, fig. 200).

Mesothamnion caribaeum Børgesen 1917: 208, figs. 194–200 (Virgin Islands)
Fig. 54*a*, *b*

LOCAL DISTRIBUTION: Forming small, dense, rounded tufts to 1 cm. high among other small algae at low levels, Sta. 8 (11262).

It was surprising to find this Nha Trang material to be in such close accord with Børgesen's account as to be referable with confidence to this West Indian species. Although my plants are somewhat smaller throughout than the type, they agree closely in habit, proportions, rhizoidal attachment, branching, and in tetrasporangial and antheridial characters. The antheridial structures are particularly striking. Cystocarps were not found.

Callithamnion sp.?
Fig. 54*e*, *j*

Mixed with other minute algae growing on bits of debris dredged from 2–4 m. off Cau Da were a few small examples about 1 cm. high of what appears to be a species of *Callithamnion* (11295). They consist of a percurrent axis about 70 μ in diameter bearing very slender branches in a spiral arrangement. Reproductive organs suggesting large spherical monospores occur, each surrounded by a group of loosely encircling filaments. These spherical structures have dense, coarsely granular contents and reach 150 μ in diameter. The present material is too scant for further elucidation.

Wrangelia argus (Mont.) Montagne 1856: 444; Børgesen 1916: 116, figs. 125–126; Weber van Bosse 1921: 220. *Griffithsia argus* Montagne 1840*a*: 176, pl. 8, fig. 4 (Canary Islands)
Fig. 54*g*

LOCAL DISTRIBUTION: Forming soft, carpet-like patches on rocks at about + 1 foot level, Sta. 1 (11084, 11113); Sta. 4 (11159).

These small plants, mostly about 1 cm. high, are characteristic of this species which is now known from the tropical Atlantic, Pacific, and Indian oceans.

Antheridia appear on some of the specimens. They are in spherical, capitate clusters in the same position and of about the same size as the tetrasporangia.

Spyridia filamentosa (Wulf.) Harvey, in Hooker 1833: 337; Taylor 1928: 197, pl. 28, figs. 14–18. *Fucus filamentosus* Wulfen 1803: 63 (Europe)
Fig. 54*i*

LOCAL DISTRIBUTION: Growing on shells and debris as soft, loose clumps 10–13 cm. high, Sta. 4, 5 (11107, 11192).

The determinate branchlets are tipped with a single spine.

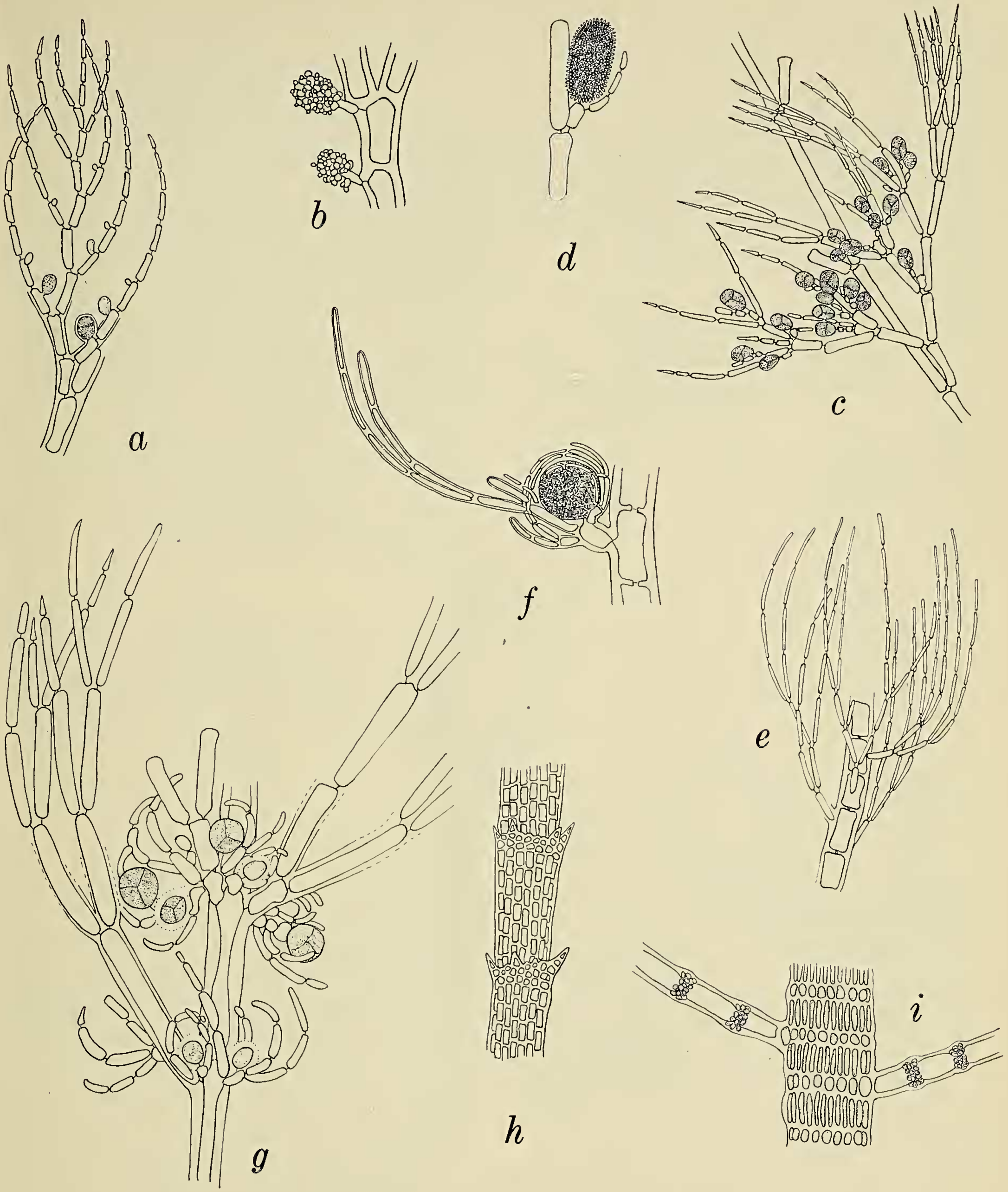

FIG. 54. *a*, *b*, *Mesothamnion caribaeum: a*, Upper portion of a tetrasporangial branch, × 75; *b*, a small part of a male branch bearing two pedicellate antheridial clusters, × 226. *c*, *d*, *Antithamnion* sp.: *c*, Part of an erect, alternately branched secondary axis bearing tetrasporangia, × 75; *d*, an antheridial branchlet, × 171. *e*, *f*, *Callithamnion* sp.: *e*, Upper portion of a percurrent axis with spirally arranged branchlets, × 55; *f*, a sporangial structure, × 93. *g*, *Wrangelia argus:* A small part of a fertile axis showing the lateral branchlets and tetrasporangia, × 96. *h*, *Centroceras clavulatum:* A small part of a filament showing the arrangement of the cortical cells and the ring of spines at the nodes, × 150. *i*, *Spyridia filamentosa:* A small part of a main axis showing the cortication and the base of two determinate branchlets, × 80.

Centroceras clavulatum (Ag.) Montagne, in Durieu 1846: 140. *Ceramium clavulatum* C. Agardh, in Kunth 1822: 2 (Peru)
Fig. 54*h*

LOCAL DISTRIBUTION: Common in various situations, epiphytic or saxicolous. Most frequently found as a component of low algal turfs on rocks. The example figured is a rather lax form from drift, Sta. 3 (11101).

Key to the Species of *Ceramium*

1. Cortication continuous except in young parts, the cells arranged in longitudinal rows . . . . **C. huysmansii**

   Cortication + − discontinuous, banded, except sometimes in old parts, the cells not in longitudinal rows 2

2. Cortical bands provided with verticils of bulbous hairs . . . . **C. fimbriatum**

   Cortical bands without bulbous hairs . . 3

3. Tetrasporangia radially arranged 4

   Tetrasporangia unilaterally arranged 6

4. Cortical bands divided by a transverse line; tetrasporangial nodes + − catenate . . . . **C. taylorii**

   Cortical bands not divided by a transverse line; tetrasporangia not causing much catenate development of nodes 5

5. Internodes long; filaments very slender, partly repent . . . . . **C. procumbens,** prox.

   Internodes very short; filaments rather coarse, erect . . . . **C. maryae**

6. Tetrasporangia free, not involucrate. . . . . **C. clarionense**

   Tetrasporangia immersed, involucrate. . 7

7. Cortical band of small, angular cells throughout . . . . **C. mazatlanense**

   Cortical band divided, the lower third of transversely elongated cells . . . . **C. gracillimum** var. **byssoideum**

Ceramium fimbriatum Setchell and Gardner 1924: 777, pl. 26, figs. 43, 44 (Gulf of California)
Fig. 55*a*

LOCAL DISTRIBUTION: Growing as a minute epiphyte on *Halophila*, Sta. 4 (11173).

Ceramium taylorii Dawson 1950*b*: 127, pl. 2, fig. 13, pl. 4, figs. 31–33 (Baja California, Mexico)
Fig. 55*b*, *c*

LOCAL DISTRIBUTION: Epiphytic and saxicolous, forming dense tufts 1.0–1.5 cm. high, Sta. 8 (11256, 11258).

The obscure *Ceramium loureiri* Agardh (1824: 137) from marine rocks of Cochin China is possibly referable here, but it is impossible to recognize it from the meager description.

Ceramium huysmansii Weber van Bosse 1923: 322, fig. 115a, b (Indonesia). *Ceramiella huysmansii* (W. v B.) Børgesen 1953: 47, figs. 18, 19
Fig. 55*d*

LOCAL DISTRIBUTION: Creeping on dead coral fragments, Sta. 7 (11245).

The present material is somewhat more slender and more branched than that described and illustrated by Weber van Bosse, but has the characteristic cortication, habit, and simple tips of her species. The tetrasporangia are embedded beneath the cortex, and in the development of these the thallus becomes constricted in a somewhat catenate manner.

Børgesen has recently proposed the new genus *Ceramiella* for this species and suggested that other species such as *C. maryae* may belong in it. He quotes, however, from a letter by Mme. Geneviève Feldmann who considers the plant a species of *Centroceras*. I prefer here to retain both *C. huysmansii* and *C. maryae* in *Ceramium* pending further study of this problem.

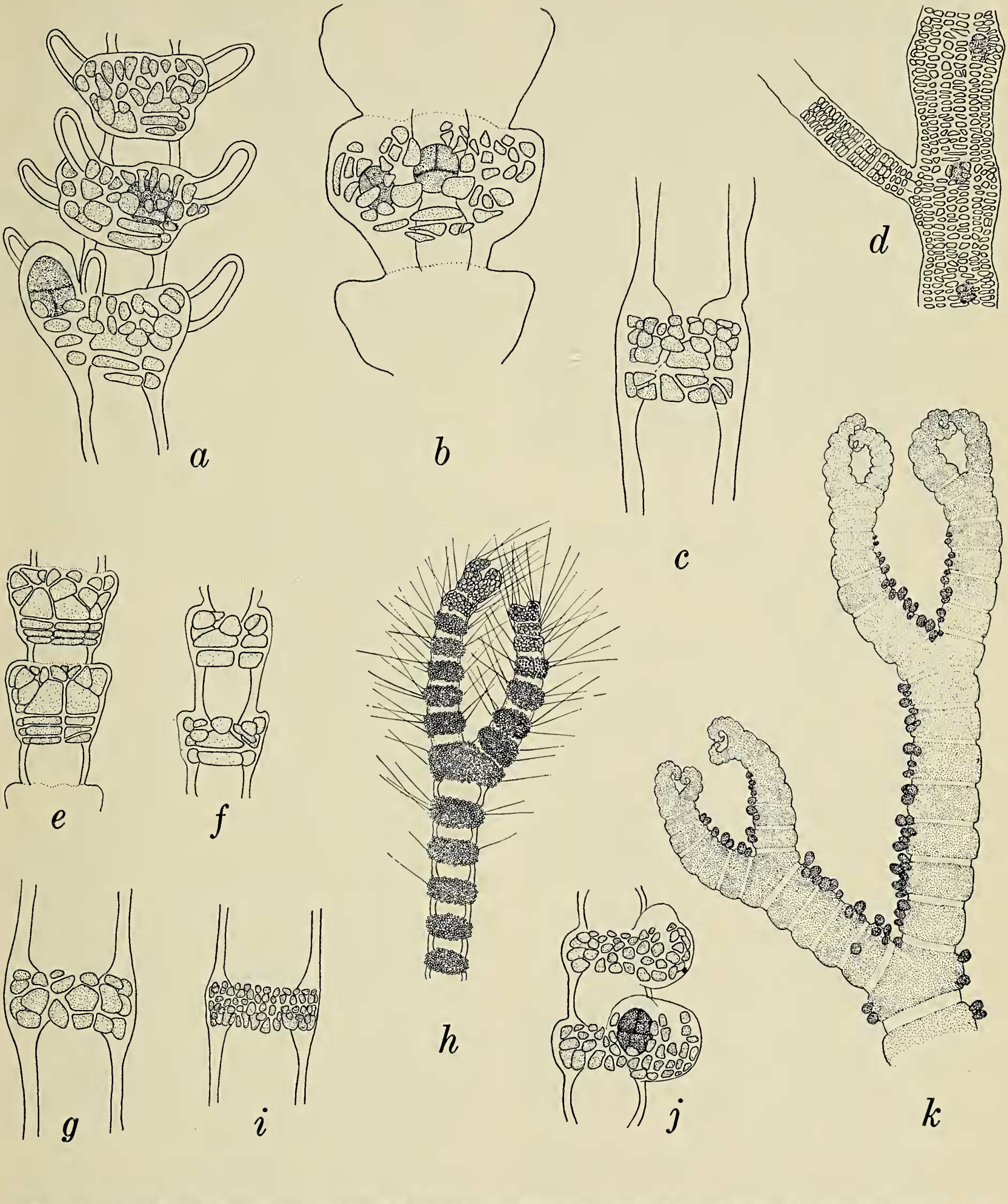

FIG. 55. *a*, *Ceramium fimbriatum:* Part of a filament showing the whorled, involucrate tetrasporangia and the thick, rounded hairs, × 230. *b*, *c*, *Ceramium taylorii: b*, Part of a fertile filament showing the whorled, involucrate tetrasporangia, × 200; *c*, a sterile node showing the division of the cortical band, × 200. *d*, *Ceramium huysmansii:* A small part of a tetrasporangial axis with a sterile lateral branch, × 150. *e*, *f*, *Ceramium gracillimum* var. *byssoideum: e*, Part of a filament of a coarser form (11378), × 200; *f*, part of a filament of a slender form (11192a), × 328. *g–j*, *Ceramium mazatlanense: g*, A sterile lower node of 11102a, × 268; *h*, upper portion of an antheridial plant, × 95; *i*, an older, lower node of an antheridial plant, × 126; *j*, part of a tetrasporangial filament of 11082, × 150. *k*, *Ceramium clarionense:* Profile of an upper part of a tetrasporangial plant showing circinate tips and emergent sporangia (after Dawson, 1950), × 55.

Ceramium gracillimum var. **byssoideum** (Harv.) G. Mazoyer 1938: 323. *Ceramium byssoideum* Harvey 1853: 218 (Key West, Florida)
Fig. 55*e*, *f*

LOCAL DISTRIBUTION: Epiphytic, 2 mm. high or less, on *Amphiroa* from 2–3 m., Sta. 2 (11378); epiphytic on *Gracilaria*, Sta. 4 (11192a).

Vegetatively the present material corresponds well with *Ceramium masonii* Dawson (1950*b*) of Pacific Mexico, but the strongly projecting, involucrate tetrasporangia are secund and adaxial as in *C. gracillimum* var. *byssoideum* which Feldmann-Mazoyer, in Børgesen (1952), has reported from Mauritius.

Ceramium mazatlanense Dawson 1950*b*: 130, pl. 2, figs. 14, 15 (Mazatlán, Mexico)
Fig. 55*g–j*

LOCAL DISTRIBUTION: Tufted on rocks, Sta. 2 (11082); epiphytic on bits of *Diplanthera* in drift, Sta. 3 (11102a); on old *Amphiroa*, Sta. 1 (11129a); among other small algae on rocks, Sta. 11 (11405); Sta. 6 (11449).

The present specimens include all reproductive phases and correspond closely (particularly tetrasporic examples) with the type material of this species from Mexico. The cortical bands tend to be slightly thicker in some specimens than in the type, and the cortical cells accordingly more numerous, but the tetrasporic plants of 11405 are quite indistinguishable from the type. Although most of the specimens are small, under 5 mm. high like the type, those of 11449 are luxuriantly developed, up to 2 cm. high.

This species may prove to be identical with *Ceramium cruciatum* Collins & Hervey to which it shows considerable resemblance except for the elongated cortical cells.

Ceramium clarionense Setchell and Gardner 1930: 170, pl. 7, figs. 25–27 (Revillagigedo Archipelago); Dawson 1950*b*: 134, pl. 4, fig. 29. *Ceramium aduncum* Nakamura 1950: 158, fig. 3a–g
Fig. 55*k*

LOCAL DISTRIBUTION: Epiphytic on old *Liagora*, Sta. 1 (11129).

Only a few small antheridial and tetrasporic plants were found, up to 1 cm. tall, but they show the strongly circinate tips, the emergent adaxial sporangia, and the deeply staining exudation droplets characteristic of this species. Nakamura has reported this plant from Formosa and northward to Japan under the name *C. aduncum*.

Ceramium procumbens Setchell and Gardner, prox. Dawson 1950*b*: 128
Fig. 56*c*, *d*

LOCAL DISTRIBUTION: Epiphytic on the surface of small algae taken from coral in 2–3 m., Sta. 2 (11373); creeping on small algae in drift, Sta. 3 (11102).

The present rather scant material agrees in size, creeping habit, and tetrasporangium production with this Pacific Mexican plant, but does not show the opposite branching usually characteristic of *Ceramium procumbens*. Erect, simple branches often arise, however, at the nodes opposite the frequent rhizoids by which the extensive, creeping, prostrate filaments are attached. The identification should be considered tentative until the branching of more representative Asiatic specimens can be examined and compared with that of eastern Pacific plants.

Ceramium maryae Weber van Bosse 1923: 324, figs. 117, 118 (Kawasa, Paternoster Islands, Indonesia)
Fig. 56*g–i*

LOCAL DISTRIBUTION: Epiphytic on larger algae and mixed in tufts of *Pterocladia*, Sta. 6 (11227).

My plants agree well with Weber van Bosse's description in size, creeping habit of the primary branches, rhizoidal attachment, non-dichotomous branching, and immersed

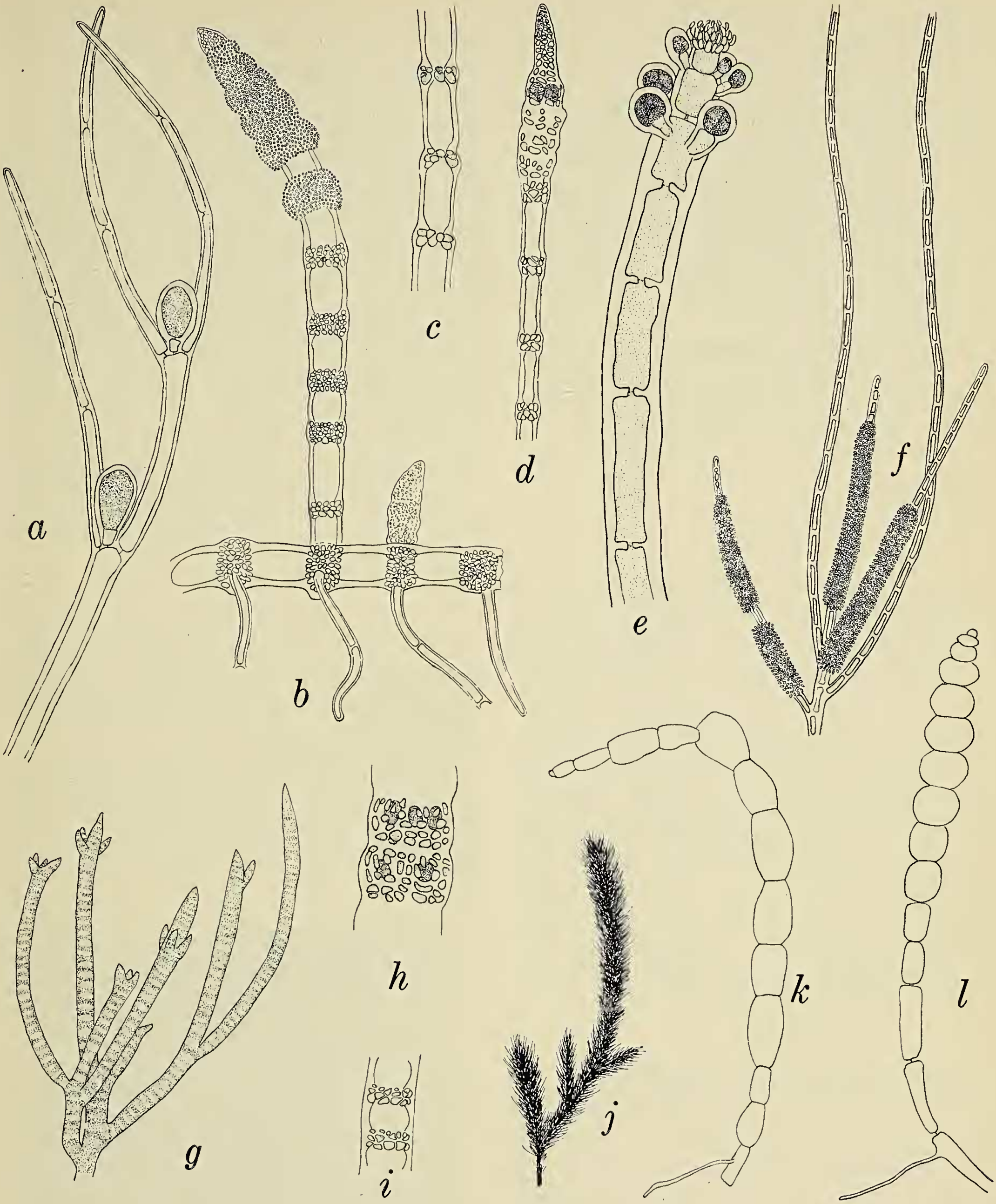

FIG. 56. *a*, *Neomonospora pedicellata* var. *tenuis:* Upper portion of a monosporangial filament, × 78. *b*, *Ceramium* sp.: A portion of a prostrate filament of 11067 bearing an erect antheridial axis, × 70. *c*, *d*, *Ceramium procumbens: c*, Part of a sterile filament of 11373, × 183; *d*, upper part of a tetrasporangial branch, × 92. *e*, *Griffithsia tenuis:* Upper portion of a tetrasporangial filament, × 80. *f*, *Dasyopsis pilosa:* Lower portion of a branched pseudolateral bearing antheridial clusters, × 91. *g–i*, *Ceramium maryae: g*, Upper portion of an immature cystocarpic plant, × 11.5; *h*, a small part of a tetrasporangial branch, × 86; *i*, a small part of a young, sterile branch, × 86. *j*, *Dasya pedicellata:* Habit, × 2.5. *k*, *l*, *Griffithsia metcalfii: k*, Part of a creeping plant of 11374, × 10; *l*, part of a young plant of 11279a, × 20.

tetrasporangia in stichidia-like, fully corticated fertile branches. Unlike the type material, these specimens have short internodes below, rarely longer than half the diameter, and are shorter and less lax throughout. These reductions and other seemingly minor differences are presumed due to the greater aggitation in the Nha Trang habitat compared to Kawasa where the type grew on reef sand. Cystocarpic examples are more erectly tufted than tetrasporic ones.

Ceramium equisetoides Nakamura (1950: 15), non *C. equisetoides* Dawson (1944: 320), is related here but is dichotomously branched and has semiemergent tetrasporangia.

Ceramium sp.

Fig. 56*b*

A small *Ceramium* was found growing with *Gelidium pusillum* in felted spots on shore rocks at Sta. 1 (11067). It was attached by multicellular rhizoids from a creeping, prostrate basal filament from which erect, curved axes arose. All the plants seen were antheridial. In habit and characters of nodal cortication this plant agrees with *Ceramium mauritianum* G. Feldmann, in Børgesen (1952: 49, fig. 25 Ia–d, 25 IIa, b), and further examination of it should be made with that species in mind.

Griffithsia tenuis C. Agardh 1828: 131 (Venice, Italy); Abbott 1946: 441, pl. 3, figs. 1–7

Fig. 56*e*

LOCAL DISTRIBUTION: A few tetrasporic filaments mixed with *Centroceras*, Sta. 9 (11319); abundant with *Champia parvula*, dredged, without other data (11138a).

The form, dimensions, and tetrasporangia agree with this species as known from various other warm-water localities in the Pacific.

Griffithsia metcalfii Tseng 1942*b*: 111, figs. 5–9 (Hainan, China)

Fig. 56*k*, *l*

LOCAL DISTRIBUTION: Only a few filaments were found, all sterile and apparently immature, creeping among other small algae taken from coral heads dredged in 2–7 m., Sta. 2 (11279a, 11374).

The material under 11374 is better developed and seems to agree in vegetative characters with *G. metcalfii*, especially with the smaller celled variety *subsecundata*, which is described as of creeping habit with frequent rhizoids. In view of the absence of reproductive material this identification must be considered tentative. The specimens show resemblance also to *G. ovalis* Harvey, as interpreted by Abbott (1946).

Neomonospora pedicellata var. **tenius** Feldmann-Mazoyer 1939: 8, fig. 1 (Villafrance, France). *Monospora indica* Børgesen 1931: 12, fig. 8

Fig. 56*a*

LOCAL DISTRIBUTION: Entangled with other filamentous algae growing on a coral rock dredged from 5–7 m. depth off the north end of Île de Tre (11279).

The present material, which consists of portions of two thalli, agrees closely with Børgesen's small Indian plant. The type of *Neomonospora pedicellata* var. *tenuis* is much

FIG. 57. *Dasyopsis pilosa:* Habit, × 1.1.

like both the Indian and the Viêt Nam plants, except that its monosporangia are sessile and more elongated. J. Feldmann more recently (1942*b*) has referred specimens from Banyuls, France, to this variety but has noted that they have pedicellate monosporangia as in the typical variety of the species. This would suggest that the small Indian, Vietnamese, and Mediterranean plants are representative of one variable species. Børgesen, himself, expressed doubt as to the distinctness of *M. indica*, and I now venture to place it in synonymy.

Dasya pedicellata (Ag.) C. Agardh 1824: 211; Taylor 1937: 355, pl. 54, figs. 1–4. *Sphaerococcus pedicellatus* C. Agardh 1822: 321 (Atlantic Europe)
Fig. 56*j*

LOCAL DISTRIBUTION: On a coral rock dredged from 5–7 m. off the north end of Île de Tre (11274).

Although these specimens are small, reaching only about 2.5 cm. in height, they are fully developed and fertile. Comparison with liquid-preserved material of *D. pedicellata* from the Atlantic and from Pacific Mexico has ervealed no significant morphological differences. They seem to be in full agreement with the illustrations given by Taylor (*l.c.*) and by other authors.

Dasyopsis pilosa Weber van Bosse 1923: 377, fig. 137 (New Guinea)
Figs. 56*f*, 57

LOCAL DISTRIBUTION: A single clump about 3 cm. high found on a coral rock at — 0.5 foot tide level, Sta. 1 (11127).

The specimen is antheridial and agrees well with Weber van Bosse's illustration and description. The dichotomous branching, the thick, cylindrical axes (to 2 mm. below), and the long, slender pseudolaterals are distinctive.

Taenioma perpusillum (J. Ag.) J. Agardh 1863: 1257; Tseng 1944*c*: 215, pl. 25; Okamura 1930, Icones 6, pl. 264, figs. 17–19. pl. 265, figs. 5–9. *Polysiphonia perpusilla* J. Agardh 1847: 16 (Pacific southern Mexico)
Fig. 58*a*

LOCAL DISTRIBUTION: Among other minute algae, Sta. 2 (11082a).

Caloglossa adnata (Zanardini) De Toni 1900: 730. *Delesseria adnata* Zanardini 1872: 141, pl. 5, B, f 1–3 (Sarawak, Borneo)
Fig. 58*b*

LOCAL DISTRIBUTION: Closely adherent on roots of mangrove, Sta. 12 (11392).

Determination by Dr. Erica Post.

Hypoglossum attenuatum Gardner 1927: 104, pl. 20, fig. 3, pl. 35, 36 (Gulf of California)
Fig. 58*c*

LOCAL DISTRIBUTION: A few small plants to 1.5 cm. long were found attached to bits of *Halimeda* from depths of 2–3 m., Sta. 2 (11369).

These plants are antheridial. They agree in habit and in the attenuation of the blades with the type material so amply illustrated by Gardner. They do not seem referable to the much larger *H. spathulatum* Kütz.

Lophosiphonia villum (J. Ag.) Setchell and Gardner 1903: 329; Hollenberg 1942*b*: 535, figs. 11–13. *Polysiphonia villum* J. Agardh 1363: 941 (Tropical America)
Fig. 58*f*, *g*

LOCAL DISTRIBUTION: Creeping on old coral, Sta. 7 (11246).

The erect, quadrisiphonous filaments of this plant reach somewhat over 3 mm. in height.

Lophosiphonia obscura (Ag.) Falkenberg 1901: 500; Børgesen 1918: 294, figs. 292–294. *Hutchinsia obscura* C. Agardh 1820: 108 (Adriatic Sea). Kützing, Tab. Phyc. 13, pl. 40a, b (as *Polysiphonia obscura*)
Fig. 58*d*, *e*

LOCAL DISTRIBUTION: Forming a loose, hairy covering to 2 cm. long on coral fragments, Sta. 7 (11247). The erect filaments are mostly unbranched.

My plants are referred here in *sensu latiori* for, although the species is usually cited as above, Howe (1920) has indicated that the "apparent original" of *Hutchinsia obscura* C. Agardh is equivalent to *Lophosiphonia subadunca* Kutzing (1843). If this is confirmed the *Lophosiphonia obscura* of recent authors (with 11 to 18 pericentral cells) should have another name which may be found either in *Conferva intertexta* Roth or *Polysiphonia reptabunda* Suhr.

Herposiphonia insidiosa (Greville, ex J. Ag.) Falkenberg 1901: 317; Tseng 1944*a*: 61; Okamura 1930, Icones 6: 35, pl. 264, figs. 10–16. *Polysiphonia insidiosa* J. Agardh 1863: 926 (Indonesia)
Fig. 58*h*, *i*

LOCAL DISTRIBUTION: Forming low tufts to 1 cm. high among other low algae, Sta. 6 (11222).

This species is semi-erect in habit and relatively coarse, the determinate branchlets being to 70–80 μ in diameter and the main axes to 120 μ in diameter. The irregular disposition of the indeterminate branchlets and the frequent absence of branches from axis segments are distinctive.

Herposiphonia tenella (Ag.) Ambronn 1880: 197, pl. 4, figs. 9, 11, 13–16; Børgesen 1918: 286, figs. 287–289. *Hutchinsia tenella* C. Agardh 1828: 105 (Mediterranean Sea)
Fig. 59*a*

LOCAL DISTRIBUTION: Creeping on *Galaxaura* growing on intertidal coral rocks, Sta. 1 (11122).

Tolypiocladia glomerulata (Ag.) Schmitz, in Schmitz and Hauptfleisch 1896–97: 441. Falkenberg 1901: 177, pl. 21, figs. 27–29. *Hutchinsia glomerulata* C. Agardh 1824: 158 (Australia, Baie de Chien Marin)
Fig. 59*b*, *c*

LOCAL DISTRIBUTION: Frequent on coral rocks, Sta. 1 (11117); on rocks, shells or debris, Sta. 4 (11156, 11427).

The material under 11117 and 11156 is small, reaching a maximum of about 2 cm. in length, while that under 11427, collected later in the season, is in full development and up to 6 cm. high. The four pericentral cells and the short, branched, determinate laterals are distinctive. The plant remains slender throughout its life, and the lateral branchlets do not anastomose.

Bostrychia radicans (Mont.) Montagne, in Kützing 1849: 839; Tseng 1943*a*: 168, pl. 1, figs. 1–3. *Rhodomela radicans* Montagne 1840*b*: 198, pl. 5, fig. 3 (French Guiana)
Fig. 59*d*, *e*

LOCAL DISTRIBUTION: Forming a low, loose mat about 3–4 mm. thick on rocks Sta. 11 (11412).

Polysiphonia fragilis Suringar 1870: 37, pl. 25B, figs. 1–4 (Kyushu, Japan); Okamura 1929, Icones 6, pl. 255
Fig. 60*a*, *b*

LOCAL DISTRIBUTION: Attached to a coral rock dredged in 5–7 m. off the north end of Île de Tre (11277).

The specimens at hand agree with the poor illustrations of Suringar in size, in their five pericentral cells, their inconspicuous trichoblasts, and rather short segments. They are in fair agreement with the more ample illustrations of Okamura. Although they are somewhat smaller throughout and show some minor morphological differences such as lack of the connecting rhizoids and reduced diameter of branch bases, they are in general accord with this species as understood by Okamura (1929) and seem better referred here than elsewhere. Segi's reasons (1951: 253) for

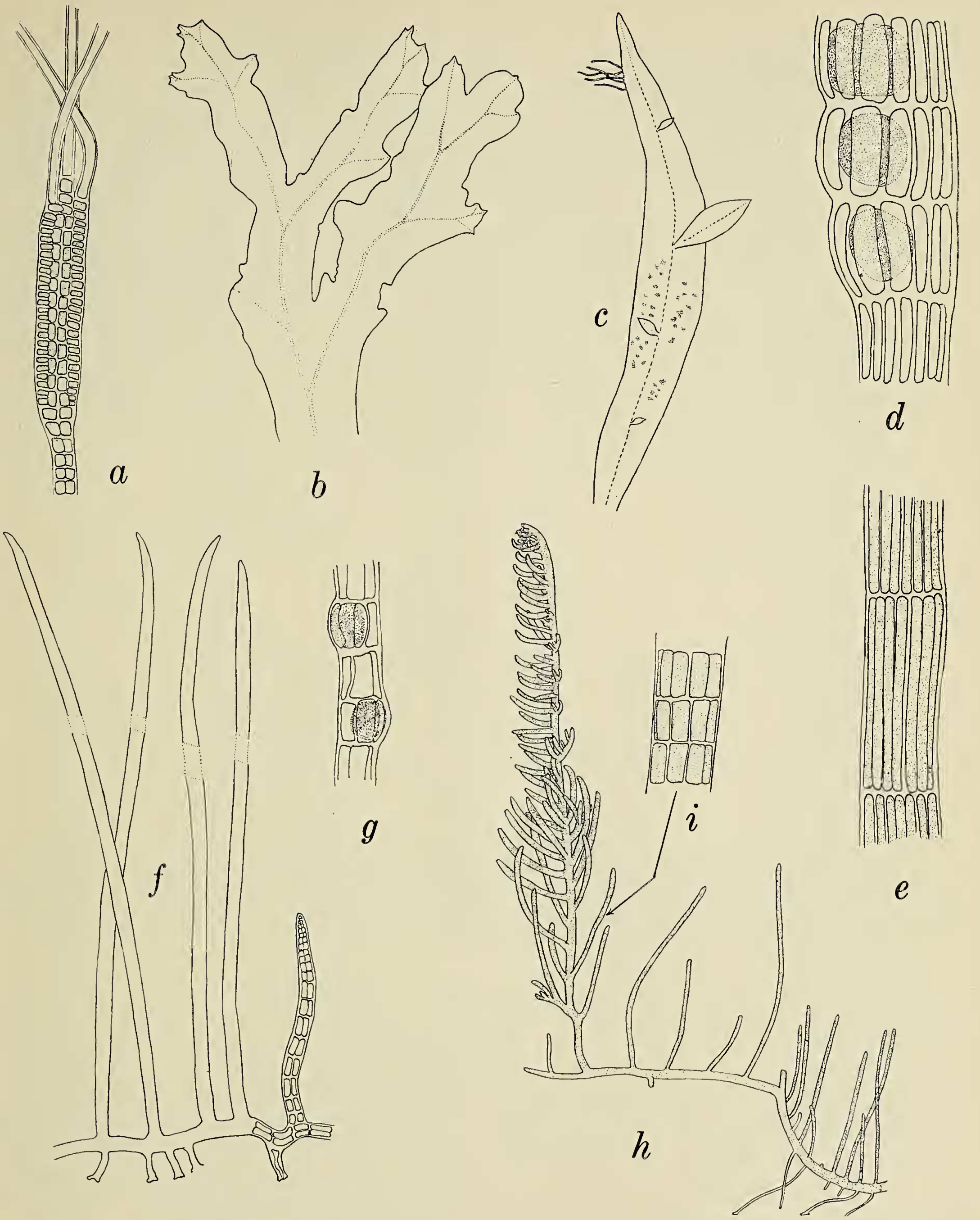

FIG. 58. *a*, *Taenioma perpusillum:* A terminal branch showing the three apical hairs, × 141. *b*, *Caloglossa adnata:* Part of a plant as seen from above, × 3.75. *c*, *Hypoglossum attenuatum:* Part of an antheridial blade showing secondary blades from the midrib and rhizoids, × 7. *d*, *e*, *Lophosiphonia obscura: d*, Part of a tetrasporangial filament, × 150; *e*, part of a sterile filament showing maximum number of pericentral cells, × 170. *f*, *g*, *Lophosiphonia villum: f*, Habit, × 36; *g*, part of a tetrasporangial filament, × 100. *h*, *i*, *Herposiphonia insidiosa: h*, Habit, × 11; *i*, part of a determinate branchlet, × 135.

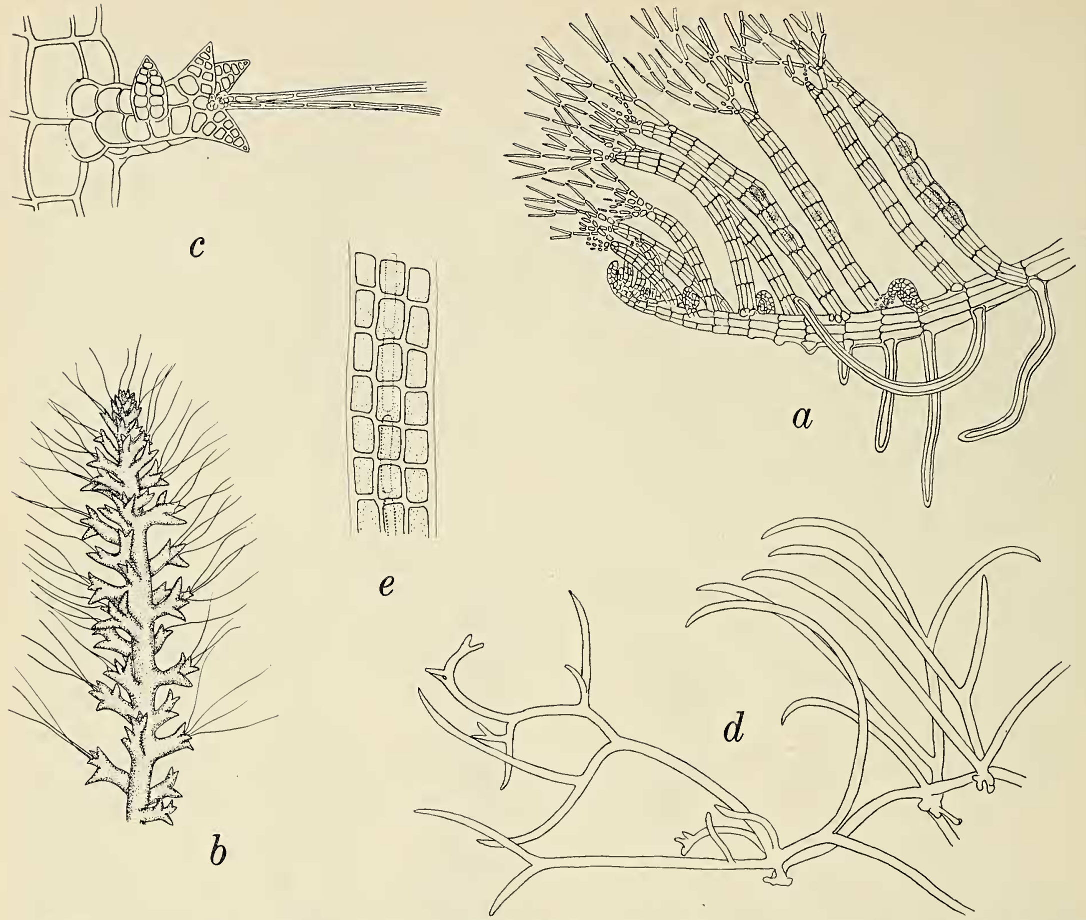

FIG. 59. *a*, *Herposiphonia tenella:* Part of a creeping axis, showing the determinate and indeterminate branches and rhizoids, × 63. *b*, *c*, *Tolypiocladia glomerulata: b*, A terminal portion of an axis, × 24; *c*, a small portion of an axis bearing one of the short, lateral branches with its acute ultimate segments and trichoblasts, × 80. *d*, *e*, *Bostrychia radicans: d*, Habit of a plant extracted from a mat, × 17; *e*, part of an erect branch showing the relation between the central axial cells and the pericentral cells, × 105.

reducing *P. fragilis* Suring. under *P. forcipata* Harv. are not clear to me.

Polysiphonia subtilissima Montagne 1840*b:* 199 (French Guiana); Tseng 1944*b*: 70, pl. 1; Kützing, Tab. Phyc. 13, pl. 28a–e
Fig. 60*c*

LOCAL DISTRIBUTION: Forming dark, densely tufted colonies 1.0–1.5 cm. high at Sta. 6 (11218).

These specimens are variable in that some possess fairly abundant trichoblasts leaving irregularly placed scar cells, while others have few or no trichoblasts and scar cells. Such plants as the latter agree well with *P. subtilissima* as it is recognized by Tseng from nearby Hong Kong. The slender proportions, 40 μ in diameter or less above, the long segments, 1.5–2 times as long as broad in midparts, and the irregular or sparse development of trichoblasts are distinctive.

Polysiphonia tongatensis Harvey, in Kützing 1864, Tab. Phyc. 14, pl. 41 (Friendly Islands). *Polysiphonia snyderae* Kylin (invalid) 1941: 35; Hollenberg 1942*a*: 784
Fig. 60*d*, *e*

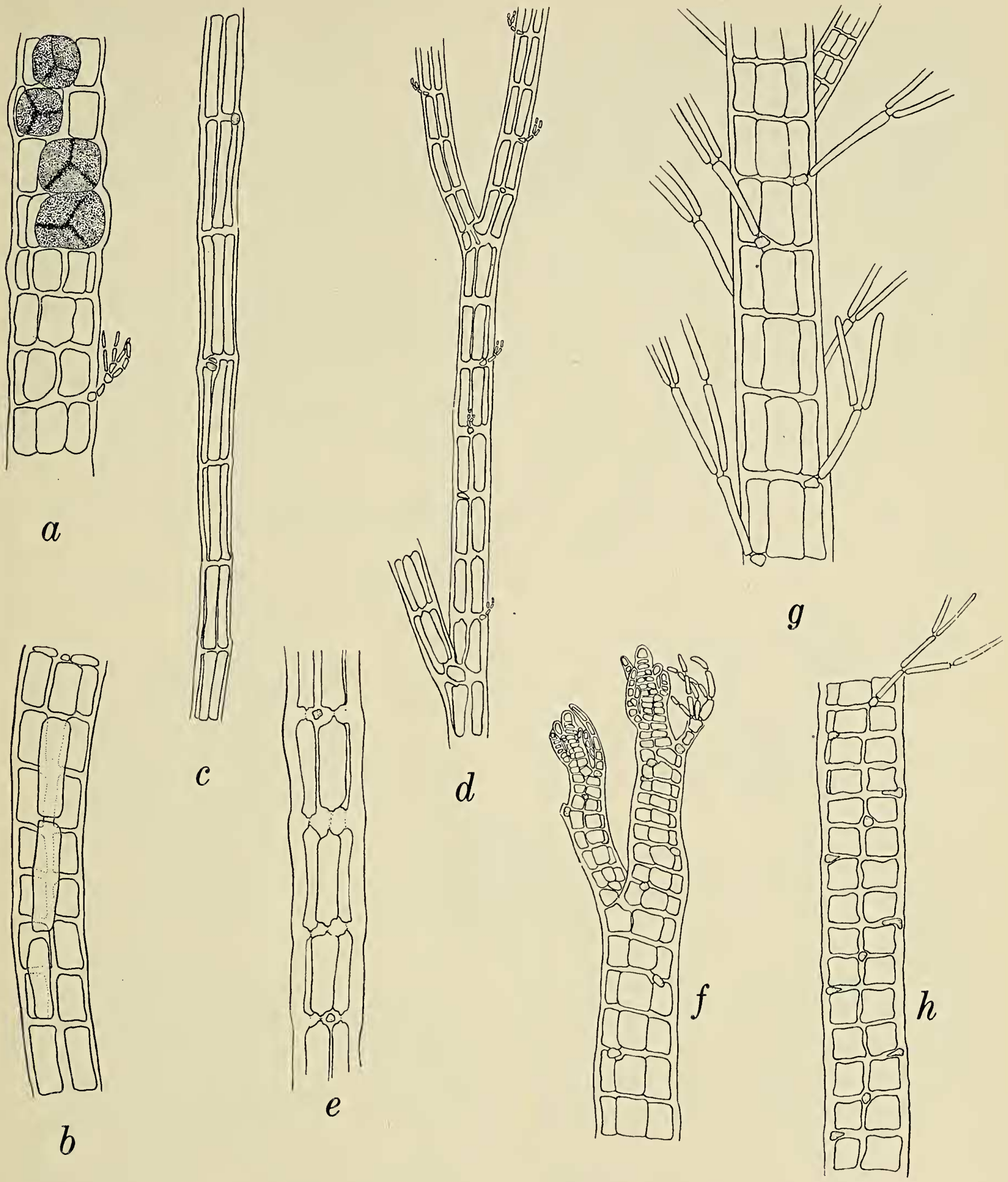

FIG. 60. *a*, *b*, *Polysiphonia fragilis: a*, Part of a tetrasporangial branch near its apex showing the arrangement of the five pericentrals and a persistent trichoblast, × 108; *b*, a portion of a branch bearing four pericentrals showing an uncommon instance of transformation to five pericentrals, × 91. *c*, *Polysiphonia subtilissima:* Mid-portion of a filament showing the sparse scar cells, one divided to initiate an exogenous branch, × 100. *d*, *e*, *Polysiphonia tongatensis: d*, An upper part of a plant showing trichoblasts, scar cells, and branches, × 65; *e*, a lower part of a plant, × 65. *f*, *Polysiphonia* sp.: Apical portion of an axis of 11329 showing irregular arrangement of scar cells, × 100. *g*, *h*, *Polysiphonia coacta: g*, Portion of a branch of 11310 near the tip, × 235; *h*, part of a branch of 11259 from a short distance below the tip, × 90.

LOCAL DISTRIBUTION: Epiphytic, 1–2 cm. tall, on *Amphiroa*, Sta. 1 (11131).

Inasmuch as the name *Polysiphonia snyderae* is invalid for want of a Latin diagnosis, and since Hollenberg states that specimens labeled *P. tongatensis* from the Friendly Islands, Society Islands, and Hawaii in the New York Botanical Garden "are very close to if not identical with *P. snyderae*," it seems best to refer the present specimens to the older name.

My plants, although rather small, are in agreement with Kützing's figure, which, however, lacks several important details such as scar cells and the nature of the base.

The epiphytic habit, attachment by unicellular rhizoids, the long segments, abundant trichoblasts, regularly placed scar cells in one-quarter divergence on each segment, and the branches replacing trichoblasts are distinctive characters.

Polysiphonia coacta Tseng 1944*b*: 71, pl. 2 (Hong Kong)

Fig. 60*g*, *h*

LOCAL DISTRIBUTION: Forming small tufted colonies 6–10 mm. high, Sta. 1 (11077, 11310); Sta. 8 (11259).

These three collections represent a short, saxicolous, quadrisiphonous species of small diameter (50–150 μ) with segments mostly shorter than broad, bearing scar cells in a regular one-quarter divergence spiral, and producing abundant connecting rhizoids. In all these characters they agree with Tseng's *P. coacta* described from sand-covered intertidal rocks at Hong Kong. The type is up to 2 cm. tall.

A collection from Sta. 10 (11329) is similar to the above specimens in size, habit, and structure, but differs in the irregular arrangement of the trichoblasts and scar cells, partly at intervals of one segment and partly at two (Fig. 60*f*). It probably represents a distinct, undescribed species, but is referred here as a close relative awaiting the more critical studies of a monographer of *Polysiphonia*.

Acanthophora spicifera (Vahl) Børgesen 1910: 201, figs. 18, 19. *Fucus spiciferus* Vahl 1799: 44 (Virgin Islands)

Fig. 61*a*, *b*

LOCAL DISTRIBUTION: Loosely ramified, to 20 cm. long, on shells and rocks, Sta. 4 (11191); in drift, Sta. 3 (11094); on rocks, Sta. 10 (11344).

Key to the Species of *Laurencia*

1. Thalli prominently flattened. . . . . **L. parvipapillata**

   Thalli cylindrical to only slightly compressed 2

2. Surface cells radially elongated, in transection arranged like a palisade 3

   Surface cells not radially elongated or arranged like a palisade 4

3. Axes + − percurrent, densely covered with short, turbinate branchlets . . . . **L. papillosa**

   Axes not percurrent; ultimate short branchlets not very dense, not turbinate . . . . **L. paniculata**

4. Thalli very small or slender, the axes and branches mostly 500 μ or less in diameter 6

   Thalli not so small or slender, the axes and branches mostly over 800 μ in diameter 5

5. Axes + − percurrent . . . . **L. obtusa var. densa**

   Axes not percurrent. **L. corymbosa**, prox.

6. Thallus articulate here and there by annular scars . . . . **L. articulata**, prox.

   Thallus not articulate 7

7. Thalli creeping on coral, loose . . . . **L. pygmaea**

   Thalli erect, densely tufted or turf-like . . 8

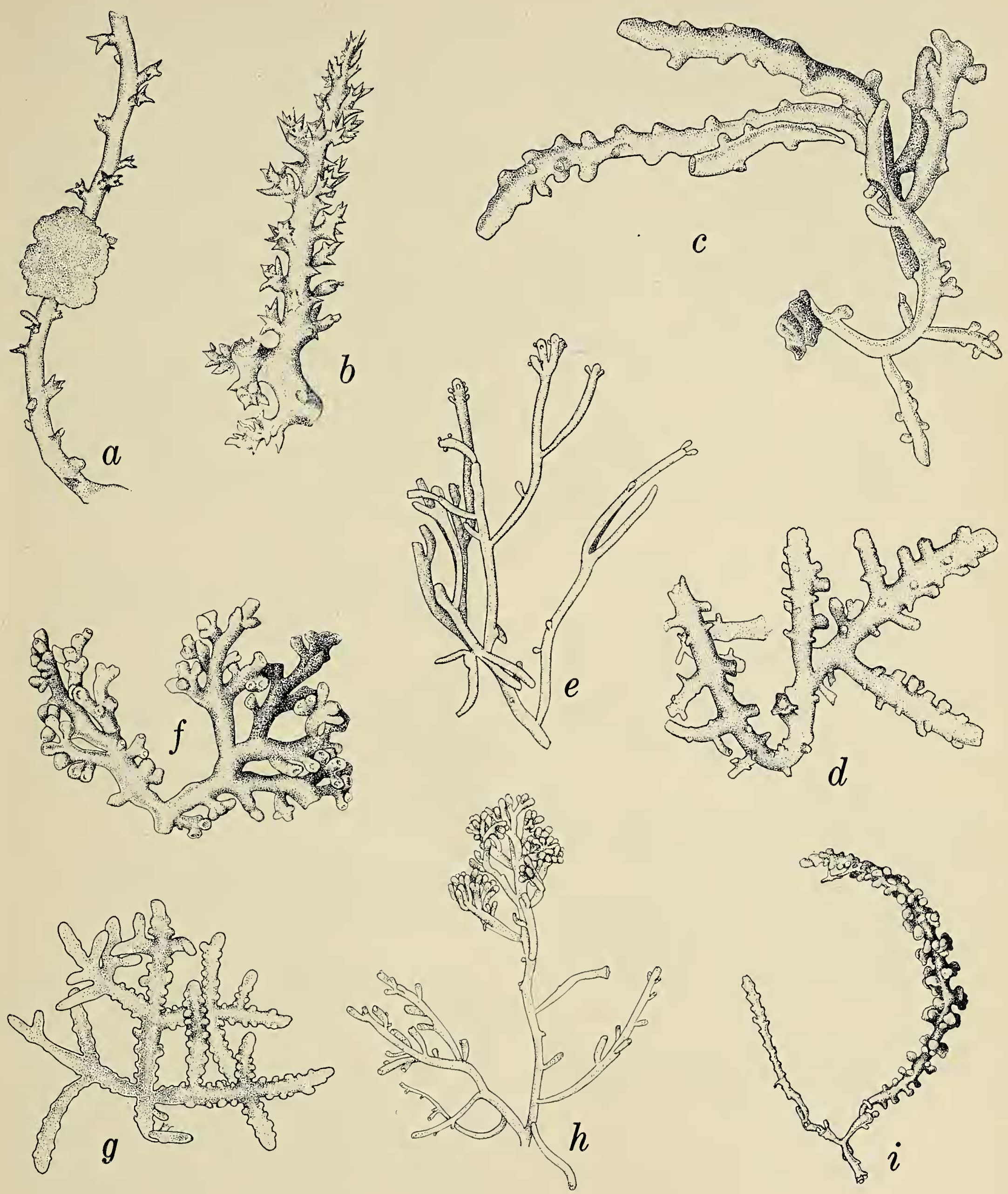

FIG. 61. *a*, *b*, *Acanthophora spicifera: a*, A branch of a lax form bearing a gall, × 4; *b*, a small portion of a more densely branched form, × 5. *c*, *d*, *Laurencia paniculata: c*, Habit of part of a slender form (11200), × 4; *d*, habit of part of a coarser form (11252), × 2. *e*, *Laurencia brachyclados*, prox.: A small part of a tuft, × 4. *f*, *Laurencia corymbosa*, prox.: Habit of part of a plant of 11311, × 3. *g*, *Laurencia parvipapillata:* Habit, × 1.5. *h*, *Laurencia obtusa* var. *densa:* Habit of part of a tuft, × 1.5. *i*, *Laurencia papillosa:* Part of a plant, × 1.5.

8. Thalli short, about 1 cm. high, repeatedly subdichotomously branched . . . **L. tenera**

   Thalli to 2 cm. high, delicate, the axes + − percurrent. . . . **L. brachyclados,** prox.

Laurencia parvipapillata Tseng 1943*b*: 204, pl. 4 (Hong Kong)
Fig. 61*g*

LOCAL DISTRIBUTION: Forming low, spreading groups a few cm. in extent on rocks, Sta. 9 (11312).

The mammillate character of the epidermal cells is distinctive.

Laurencia papillosa (Forsk.) Greville 1830: lii; Yamada 1931: 190, pl. 1, figs. a, b. *Fucus papillosus* Forskål 1775: 190 (Red Sea)
Fig. 61*i*

LOCAL DISTRIBUTION: Sta. 4 (11196).

Laurencia paniculata (Ag.) J. Agardh 1863: 753; Yamada 1931: 192, pl. 3, fig. a; Tseng 1943*b*: 191. *Chondria obtusa* var. *paniculata* C. Agardh 1822: 343 (Adriatic Sea)
Fig. 61*c*, *d*

LOCAL DISTRIBUTION: On rocks, Sta. 4 (11200); on coral in shallow water, Sta. 7 (11252); on rocks, Sta. 10 (11343).

In referring my specimens to this species, I concur with Tseng as to the need of more exact information about the Adriatic type of *L. paniculata.*

Laurencia obtusa var. **densa** Yamada 1931: 226, pl. 17, fig. c (Daibanratsu, Formosa)
Fig. 61*h*

LOCAL DISTRIBUTION: Tufted, to 4 cm. high on rocks, Sta. 8 (11270).

Although somewhat smaller throughout, these specimens seem to be in agreement with Yamada's plant from nearby Formosa.

Laurencia corymbosa J. Agardh, prox.
Fig. 61*f*

LOCAL DISTRIBUTION: On rocks, Sta. 9 (11311). These specimens are dwarfish and clearly not fully developed. They seem to approach *L. corymbosa* most closely according to Yamada's key (1931).

Laurencia articulata Tseng, prox. Tseng 1943*b*: 195, pl. 2, figs. 3, 4 (Hong Kong)
Fig. 62*h–j*

LOCAL DISTRIBUTION: Minute, creeping on coral rock dredged from 5–7 m. off north end of Île de Tre (11282).

The supposedly characteristic annular scars are frequent, and in habit my scant material appears to agree with Tseng's species. However, my plants are sexual whereas his were tetrasporic. More collections and further comparisons are needed.

Laurencia pygmaea Weber van Bosse 1913*a*: 122, pl. 12, fig. 6 (Chagos Archipelago)
Fig. 62*k*

LOCAL DISTRIBUTION: Creeping on coral fragments from drift, Sta. 2 (11361a).

I have found only a few sterile plants, but they are in good agreement with the description by Mrs. Weber.

Laurencia tenera Tseng 1943*b*: 200, pl. 1, fig. 6, pl. 2, figs. 5, 6 (Hong Kong)
Fig. 62*b*, *c*

LOCAL DISTRIBUTION: Forming a low, dense, turf-like mass about 1 cm. high, Sta. 8 (11257).

These small plants appear to agree with Tseng's *L. tenera* described from a similar habitat at Hong Kong. Cystocarps were not reported by Tseng. The branches bearing them are considerably smaller in diameter than are tetrasporangial branches.

Laurencia brachyclados Pilger, prox. Yamada 1931: 216; Pilger 1920: 6, figs. 9, 10 (Annobon Island, Gulf of Guinea)
Fig. 61*e*

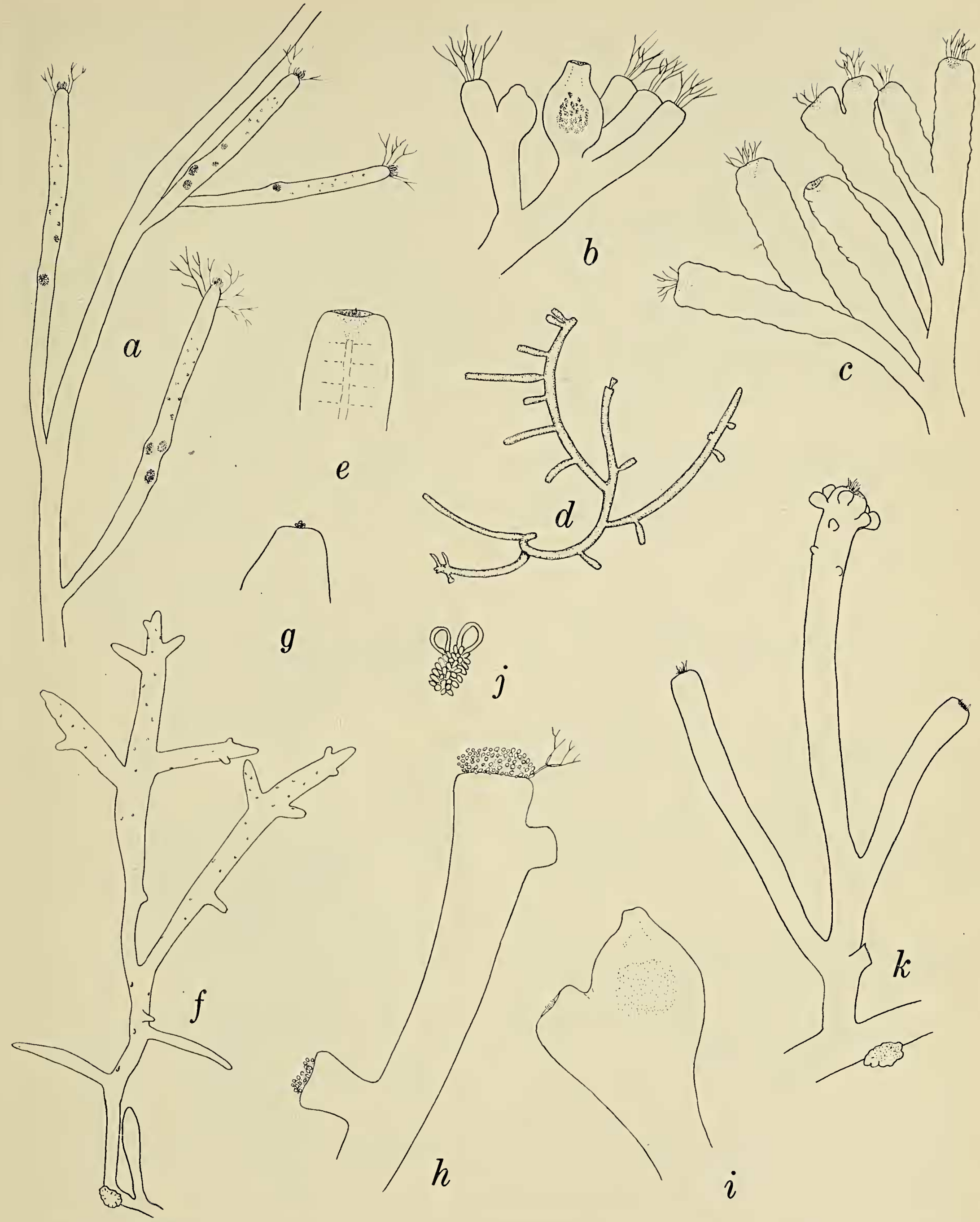

FIG. 62. *a*, *Chondria baileyana:* Middle portion of a tetrasporangial plant, × 12. *b*, *c*, *Laurencia tenera:* *b*, Part of a cystocarpic thallus, × 19.5; *c*, upper portion of a thallus bearing immature tetrasporangia, × 9.5. *d*, *e*, *Chondria repens:* *d*, Habit, × 2.75; *e*, apex of an erect branch, × 135. *f*, *g*, *Chondria dangeardii:* *f*, Habit of a sterile plant, × 3; *g*, apex of a branch, × 30. *h–j*, *Laurencia articulata*, prox.: *h*, A terminal portion of an antheridial plant, × 17; *i*, a cystocarp, × 17; *j*, an antheridial filament, × 230. *k*, *Laurencia pygmaea:* Part of a plant showing erect axes from a prostrate branch, × 20.

LOCAL DISTRIBUTION: Sta. 10 (11342).

My plants appear to agree with this little-known species according to Yamada's treatment of it, but it has not been possible to compare with any east Atlantic specimens. The type is presumed lost.

Chondria repens Børgesen 1924: 300, fig. 40 (Easter Island)

Fig. 62*d*, *e*

LOCAL DISTRIBUTION: Two small plants found creeping on a coral fragment, Sta. 7 (11249).

Chondria baileyana (Mont.) Harvey 1853: 20, pl. 18 A; Taylor 1937: 358, pl. 55, fig. 4. *Laurencia baileyana* Montagne 1849: 63 (New York, U.S.A.)

Fig. 62*a*

LOCAL DISTRIBUTION: Dredged from 2–4 m., Sta. 2 (11297); dredged from 5–7 m. off north end of Île de Tre (11276).

The specimens at hand are small and in part fragmentary, but seem to agree with this species in diameter, branching, branch shape, cortex, and tetraspore production. They correspond well, except for stature, with specimens distributed as No. 43 in Phyc. Bor. Amer.

Chondria dangeardii nom. nov. *Chondria platyclada* P. Dangeard 1952: 303, pl. 21, fig. A-I (non *Chondria platyclada* Taylor 1945: 295) (Dakar, Senegal)

Fig. 62*f*, *g*

LOCAL DISTRIBUTION: Attached to a piece of coral dredged in 2–3 m., Sta. 2 (11372); on coral rocks at −0.5 foot tide level, Sta. 1 (11130).

These two collections, one sterile and one tetrasporic, are in excellent agreement with Dangeard's African plant. In the sterile example shown in Figure 62*f* branch primordia are present in small pits on the thallus surface, while in the tetrasporic examples these have grown out into short branchlets as shown in Dangeard's figures.

The flat thallus with pinnate primary branching is characteristic.

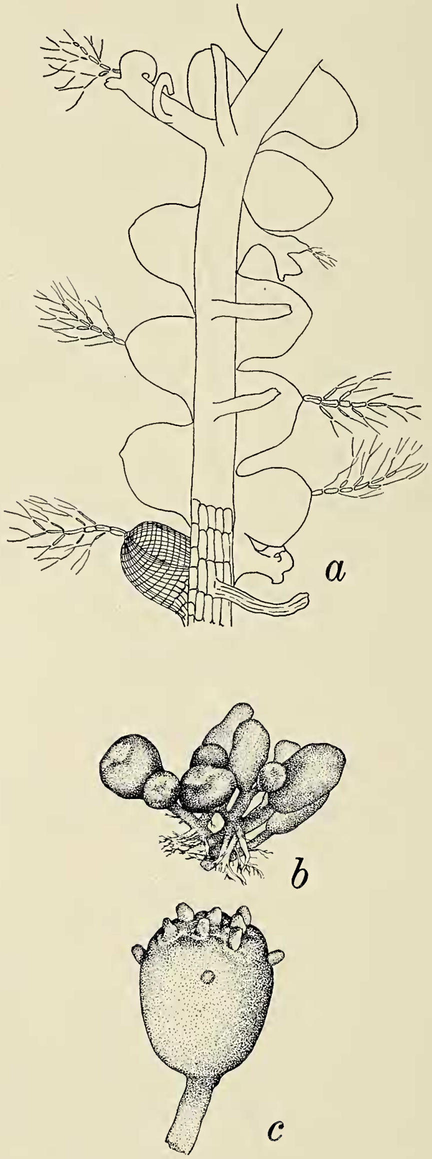

FIG. 63. *a*, *Leveillea jungermannioides:* A somewhat diagrammatic representation of part of a thallus as seen from below, showing determinate lateral blades with trichoblasts, the indeterminate shoots, and several rhizoidal attachments, × 17. *b*, *c*, *Acrocystis nana: b*, Habit, × 1.5; *c*, detail of a single branch bearing nipple-like tetrasporangial stichidia, × 4.

Acrocystis nana Zanardini 1872: 145, pl. 8, fig. A, 1–6 (Borneo); Okamura 1907, Icones I, pls. 6, 7

Fig. 63*b*, *c*

LOCAL DISTRIBUTION: Growing in groups on seaward faces of larger rocks, Sta. 11 (11408).

Leveillea jungermannioides (Mart. & Her.) Harvey 1855: 539; Falkenberg 1901: 392, pl. 6, figs. 1–13, pl. 14, figs. 18–27; Scagel 1953: 51, fig. 8. *Amansia jungermannioides* Martens and Hering 1836: 485, pl. 1 (locality not indicated)

Fig. 63*a*

LOCAL DISTRIBUTION: Growing on and around small algae on coral rocks, Sta. 1 (11132).

The present material is quite small for the species, measuring only about 1.5 mm. across the thallus. It is, however, in actively growing condition and perhaps somewhat young.

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